The Blast Furnace and Steel Plant

The Blast Furnace and Steel Plant

Published the first of each month by the National Iron and Steel Publishing Co.

Main Office — Thaw Building, 108 Smithfield Street, Pittsburgh.

DISTRICT OFFICES — NEW YORK AND CHICAGO.

President: H. A. Andresen. Vice President and Treasurer: F. C. Andresen. Secretary: M. M. Zeder.
Engineering Editor: ALFRED M. STAEHLE. Associate Editor: A. W. PETERSON.

EDITORIAL ADVISORY BOARD:

William A. Field, W. Trinks, Fred Crabtree, Kenneth B. Lewis,
Barton R. Shover, Dr. George B. Waterhouse, E. H. McClelland, A. G. Smith

Subscription Price:—In the United States, $1 per year; Canada, $1.50; all other countries, $2. Single Copy, 15 Cents.
Entered as second-class mail matter at Pittsburgh, Pa., under the Act of Congress, March 3, 1879.

Index to Contents

VOL III. APRIL, 1919. No. 4

Page

ENGLISH ELECTRIC FURNACE DEVELOPMENTS 169
BY F. J. MOFFETT.

HEATING FURNACES AND ANNEALING FURNACES—PART IV 171
BY W. TRINKS.

MODERN STEAM POWER STATION EQUIPMENT 177
BY JOSEPH G. WORKER.

ROLLING MILL RESEARCH LABORATORY FOUNDED 183

NEW DRY CLEANER FOR BLAST FURNACE GAS 185
BY J. C. BARRETT.

WATER COOLED EQUIPMENT FOR OPEN HEARTHS 188
BY WILLIAM C. COFFIN.

Page

NEW BLAST FURNACE GAS CLEANING OUTFIT 193

METALLURGICAL WORK OF BUREAU OF STANDARDS—PART II 195
BY G. K. BURGESS.

FOREIGN RELATIONS 198

SOME POINTERS ON BY-PRODUCT COKE OVEN OPERATION 200

NEWS OF THE PLANTS 201

INDUSTRIAL RELATIONS 202

PRODUCTION TOPICS 203

OPEN HEARTH 204

WITH THE EQUIPMENT MANUFACTURERS 206

TRADE NOTES, TRADE PUBLICATIONS, SOCIETY MEETINGS 208

Generated on 2024-09-08 14:04 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

The Blast Furnace and Steel Plant

VOL. VII. PITTSBURGH, PA., APRIL, 1919. No. 4

English Electric Furnace Developments

Advantages of Electric Furnace Practice Pointed Out—High Efficiency and High Temperature Possibilities—Reductions of Heat Losses by Air Tight Furnaces Enables a Reducing Atmosphere.

By F. J. MOFFETT.

Recent interesting developments of the electric steel furnace in England were described by the author of a paper before the Staffordshire Iron and Steel Institute, England, the following abstract of which appeared in the Iron and Coal Trades Review of England.

In a steam-driven station supplying electricity the efficiency of the best boilers does not at present exceed 75 per cent, which means that 25 per cent of the energy of the coal is lost at this stage. The steam generated in the boiler is then passed into the turbines, the efficiency of which does not often reach 25 per cent; there is, therefore, a loss here of 75 per cent. In the generators the efficiency may be 95 per cent and the efficiency of transformation and transmission may be taken at 85 per cent. The overall efficiency from the coal to the units of electricity in the furnace will therefore be roughly 15 per cent. In spite, however, of this low efficiency from fuel to units at furnace, the electric furnace can, in certain directions, show better results than the combustion furnace. Undoubtedly the chief reason lies in the fact that the electric furnace itself is so much higher in efficiency than the combustion furnace. Dr. Stansfield has carefully examined this question, and the figures quoted here are due to him. The efficiency of any furnace—combustion or electric—is the ratio between the heat usefully employed in the furnace to the heat value of the fuel used or the electric energy supplied. Take first the crucible furnace for melting steel:

$$\text{Efficiency} = \frac{\text{Weight of steel melted} \times \text{heat to melt 1 lb. steel.}}{\text{Weight of coke} \times \text{heat furnished by 1 lb. coke.}}$$

$$= \frac{100 \text{ lbs.} \times 540 \text{ Btu}}{150 \text{ lbs.} \times 13{,}000 \text{ Btu}} = 0.028.$$

The efficiency of this furnace is therefore 2.8 per cent. Now take the electric steel furnace. The charge consisted of: Steel scrap, 5,733 lbs.; iron ore, 430 lbs.; lime, 346 lbs.; total, 6,509 lbs. It required 1,680 kw hours to melt this charge, but in addition some heat was furnished by the reaction between the steel scrap and the iron ore. Hence the heat supplied to the furnace was 1,680 kw hours of electric energy = 5,700,000 Btu; reaction between steel scrap and iron ore = 43,000 Btu; hence total = 5,743,000 Btu. The heat utilized in the furnace was: To melt 5,660 lbs. soft steel = 3,485,000 Btu; to melt 850 lbs. basic slag = 920,000 Btu; hence total 4,405,000 Btu. The efficiency of the electric furnace is therefore 77 per cent roughly, as against the efficiency of the crucible steel furnace of 2.8 per cent.

The following figures give the approximate efficiencies of furnaces used for melting metals: Crucible steel furnace, 2—3 per cent; reverberatory furnaces, 10—15 per cent; regenerative open hearth, 20—30 per cent; foundry cupolas, 30—50 per cent; electric steel furnaces, 60—85 per cent.

Apart from the high efficiency of the electric furnace, it possesses other advantages over the combustion furnace for special purposes such as refining steel. One of the most important of these is the possibility of obtaining high temperatures. The temperature of the volatilization point of carbon is in the neighborhood of 3,500 degrees C., so that it is easy to obtain temperatures of 2,000 degrees C. and upwards. With a combustion furnace the temperature limit is, of course, much lower.

Speaking generally, low temperature heating is done more economically by combustion, whereas for the higher temperatures about 1,500 degrees C. it is cheaper to use electricity. The cheapest way to reach temperatures above 1,500 degrees C. is to combine the two systems, i.e., to use combustion heat for melting and electric heat for refining. This is being done to an increasing extent in many steel works at the present time, crucible or open hearth furnaces being used for melting and electric furnaces for finishing.

Another advantage of the electric furnace is the

Generated on 2024-09-08 14:02 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

ability to obtain a neutral or a reducing atmosphere in the furnace, as it is possible to seal it up and render it more or less airtight. The proportion of oxygen can be reduced at will, and the atmosphere becomes in consequence either simply neutral or even capable of taking up oxygen from the charge that is deoxidizing or reducing. The possibility of rendering the electric furnace airtight has the further advantage that the heat losses are greatly reduced, and it is largely due to this fact that the efficiency is so high.

Among other advantages may be enumerated: Rapidity of heating; absence of impurities introduced by the combustion of fuel such as sulphur; ease, accuracy, and reliability of control and regulation; greater uniformity of the product; and greater output for a given size of furnace.

The author next described the different types of electric furnaces, and then the method of operation of the steel furnace. After the furnace has been fettled from the previous charge, the cold scrap is thrown into the hearth. When charging is completed the current is switched on and kept as constant as possible, either by hand or by an automatic regulator. Melting soon begins, and during this period the flux is added, consisting of a mixture of lime, fluorspar, sand, and either iron ore or banner scale. This flux floats on the top of the molten metal, and the chemical actions of refining take place. The carbon in the scrap is oxidized by the oxygen in the iron oxide of the flux and is given off as carbon-monoxide. This rising through the bath gives the appearance of boiling, and has the effect of thoroughly mixing the flux and the metal. The silicon and the manganese are oxidized, and these oxides dissolve in the flux. The phosphorus also is oxidized, and forms, with the lime, a phosphate which also enters into the slag. A portion of the sulphur oxidizes and passes away in the gaseous state. When sufficient time has been allowed for these reactions to take place, the current is switched off, and the slag run off by tilting the furnace, the surface of the metal being carefully cleared. An addition of carbon is then made to provide the necessary carbon in the steel, and a second flux is thrown in, this also consisting of lime, sand and fluorspar. During the subsequent refining only about half the voltage is required. The phosphorus has already been removed, but the bulk of the sulphur and a certain amount of iron oxide still remains. This iron oxide is solved in the second flux, and is removed by the addition of finely-powdered anthracite dust, which reduces the iron oxide, and at the same time forms a reducing atmosphere in the furnace. The sulphur is also gradually dissolved in the flux, and at the end of the second purification the metal is ready for pouring.

The most important field for the electric steel furnace is the production of a uniformly good quality of steel from cheap scrap material such as turnings and crop ends, which can be fed into the furnace without any preparation. In the case of alloy steels, it is possible to make a steel of uniform composition since the amount of alloy to be added can be calculated exactly from the analysis of the steel in the furnace. Steels containing nickel, chromium, vanadium, etc., can be melted without any loss of these elements. Steel castings can be produced which are dead mild and do not require any subsequent annealing. The properties of ordinary electric cast steel are: Tensile strength, 35 tons per sq. in.; yield point, 25 tons; and elongation, 30 per cent. By the addition of elements such as nickel, a much higher tensile strength can be obtained. The electric steel casting is therefore capable of taking the place of a steel forging for many purposes. Owing to the high temperature at which the charge can be poured, the steel is very fluid and allows of castings of intricate shape being made without difficulty. Electric steel castings will doubtless in the near future take the place of malleable iron castings, which have to be treated by a tedious and expensive annealing process.

At the end of the year 1917, the furnaces installed were as follows: Héroult, 46 varying from 1½ to 10 tons; Greaves-Etchell, 31 varying from ½ to 12½ tons; Electro-metals, 27 varying from 1½ to 10 tons; Rennerfelt, 8 varying from ¾ to 2½ tons; Stobie, 6 varying from 5 to 15 tons; other makes, 22. It is of interest to mention that of the above 140 furnaces nearly one-half are in the Sheffield and Rotherham district. Further, it is evident that the arc type of furnace has established its superiority from a commercial point of view. The induction furnace is now very rarely adopted in this country for steel refining. (These figures refer to English installations.)

The following is a list of standard sizes of furnaces with the transformer capacity and the approximate units per ton of finished steel:

Size.	Transformer capacity.	Units per ton.
25 cwt.	300 kw	850
2½ tons	500 kw	800
5 tons	800 kw	750

It is evident that the units per ton are less in the larger furnaces; this decrease does not go on indefinitely; when the capacity of 15 tons is reached, the units per ton appear to reach their minimum value. Sir Robert Hadfield, in a recent account of the fuel and electric power consumption in his works at Sheffield, stated that in 1917 the units per ton used for 31,850 tons of electric steel was 782.

The cost of electrical energy is the most important consideration in the operation of an electric furnace. When it is possible to use blast-furnace or coke-oven gases for the generation of electricity, the cost can be brought very low. If a by-product recovery plant is employed, gas can be produced cheaply and used for driving electric generators by gas engines.

Generated on 2024-09-08 14:04 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

Heating Furnaces and Annealing Furnaces

Heat Carried Out by Flue Gases With Various Degrees of Excess Air — Heat Available for Keeping Furnace Hot and Methods of Calculation.

By W. TRINKS.

PART IV.

The calculation of the heat losses through walls and openings as explained in Part III, of this series, is only an intermediate step in the calculation of the fuel consumption. In order to compute the fuel consumption from the losses we proceed as follows: The flue gases carry away with them a large fraction of the heat generated by combustion of fuel, the fraction lost depending upon the temperature of the flue gases, and upon their composition. The difference between the heat of combustion per unit quantity of fuel and the heat lost in the flue gases for unit quantity of fuel represents the heat units (also per unit quantity of fuel) which are available for keeping the furnace hot. The consumption of fuel per hour required for keeping the furnace hot is found from the quantity of fuel per

$$\text{hour} = \frac{\text{heat losses from furnaces per hour}}{\text{heat units (per unit quantity of fuel) available for keeping furnace hot}}$$

Calculation of the heat lost in the flue gases is quite tedious, which probably is one of the reasons for the large amount of guess work done in conjunction with furnace calculations. As stated before, the heat loss depends not only on the temperature of the flue gases, but also on the excess or deficiency of combustion air. For the purpose of facilitating these calculations, the curves in Figures 25 to 31, inclusive, are offered.* From these curves the fraction of the heat lost to the flue gases can be found with very little trouble, provided that combustion is perfect or else carried on with excess air. Two curves are given in each instance. The A curve shows the heat in the gases of perfect combustion (of unit quantity of fuel) as a function of the temperature of the flue gases. The B curve has no direct physical meaning, but is very convenient for calculation purposes. It represents the heat in the air which is required to burn unit quantity of fuel, plotted as a function of the temperature of that air. If combustion has been carried on with excess air, or if air has filtered into the furnace after the combustion, the flue gases contain excess air. If the amount of that excess air is p per cent, the heat in the flue gases, per unit quantity of fuel for a given temperature, is found by taking the ordinate of the A curve for the temperature in question, and by adding to it p per cent of the ordinate of the B curve. An example will make the use of these curves clear. Let natural gas be burnt with 20 per cent excess air, then what is the heat in the flue gases produced by the combustion of one cubic foot of standard gas, provided that the flue gases leave the furnace with a temperature of 1,600 degrees F? Refer to Fig. 27. The heat in the flue gases is 370 + .2 × 280 or 426 Btu per cu. ft. of standard gas.

For those who wish to familiarize themselves with the methods of calculation employed in the making of these curves, a sample calculation is given in the appendix to this instalment.

To find the heat (per unit quantity of fuel) which is given up to the furnace walls, we deduct the heat in the flue gases from the sum of the heat of combustion and the sensible heat of the fuel mixture. If the fuel and the air enter the furnace with atmospheric temperature, it is, for most calculations, sufficient to deduct the heat in the flue gas from the heat of combustion, although strictly speaking, the sensible heat of the fuel mixture should also be considered. An example will clear up this point. Take the same conditions as before, namely, the products of combustion of natural gas with 20 per cent excess air leaving at a temperature of 1,600 degrees F. The heat of combustion is 1,000 Btu per cubic foot, while the flue gases take away 426 Btu. In consequence, 1,000 — 426 = 574 Btu are given up to the furnace, if the fuel mixture enters at 0 degrees F. If, however, the air is preheated to 1,000 degrees F, then the heat entering the furnace per cubic foot of gas is 1,000 Btu + 1.2 times the ordinate of the heat in the air at 1,000 degrees F., or 1,000 Btu + 1.2 × 160 Btu, which equals 1,000 + 192, or 1,192 Btu. The heat given up per cu. ft. of gas in that case equals 1,192 — 426 = 766 Btu, if the sensible heat in the natural gas is neglected. Natural gas, coke oven gas, town gas, oil, and coal are seldom preheated and the sensible heat in these fuels may well be neglected when they enter cold, but with blast furnace gas and producer gas, matters are different. For that reason, a third, and shorter curve marked C has been added for these three fuels, giving the heat contents of the fuels. For the sake of completeness the C curve has also been shown for coke oven gas and for natural gas. After the amount of heat given up to the furnace per unit quantity of fuel has been determined, the fuel consumption per hour is easily found.

Take, for instance, the furnace used as an example

*Curves of Figures 25-31 were computed by Prof. Thomas G. Estep.

Generated on 2024-09-08 14:05 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

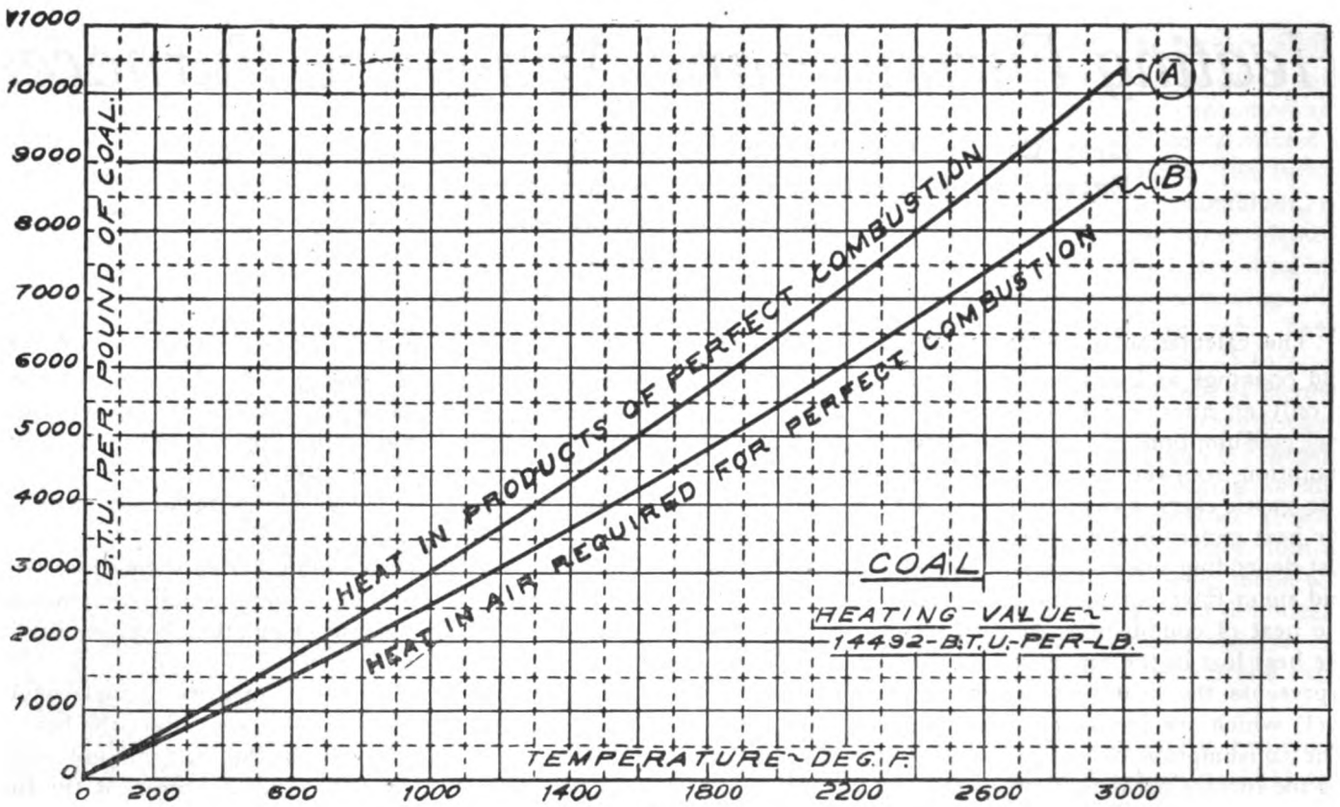


FIG. 25—COAL.

Ultimate Analysis.

Carbon	79.86
Hydrogen	5.02
Oxygen	4.27
Nitrogen	1.86
Sulphur	1.18
Ash	7.81
	100.00

Products of Combustion.
Pounds per pound of coal.

CO_2	2.953
N_2	8.318
H_2O	.452

Air required for perfect combustion = 10.8 pounds per pound of coal.

in Part III, in which the heat loss was 192,000 Btu per hour, for a furnace temperature of 1,800 degrees F. Let the fuel be coke oven gas, the fuel mixture entering at 100 degrees F, and let the excess of air be 15 per cent. Refer to Fig. 26. The heat in the flue gases equals $200 + .15 \times 157 = 224$ Btu per cu. ft. of gas. The heat of combustion is 510 Btu, while the sensible heat of the fuel mixture is roughly 18 Btu, making the total initial heat of the products of combustion equal to 528 Btu. The difference, which equals $528 - 224 = 304$ Btu, is therefore given up per cu. ft. of gas, and $\frac{192{,}000}{304} = 631$ cu. ft. of gas per hour are required to keep the furnace hot.

Although the curves of heat losses, given in Part III, in conjunction with the curves given above, facilitate fuel consumption calculations very much, they do not eliminate calculations altogether. That latter goal, namely, direct reading of fuel consumption from a set of curves, is possible, and advisable, wherever one and the same fuel is used at all times with constant temperature of fuel mixture. The procedure for making such a curve, or set of curves, is plain. For a given furnace temperature and a given thickness and composition of wall, find the heat loss per sq. ft. and hour from Fig. 20. Then compute the fuel consumption for a given fuel and given temperature of fuel mixture, as was done in the preceding paragraph. The resulting fuel consumption gives one point in the curve. Fig. 32 shows the fuel consumption (per 100 sq. ft. of wall surface) which is required to maintain the temperature of a furnace with walls of 9 inches of fire brick at various values (for a room temperature of 60 degrees F), if fuel oil is burned with 5 per cent excess air, and if oil and air enter at 100 degrees F.* It is easily seen that the fuel consumption grows tremendously with the temperature; first, because the heat losses grow with the temperature, and second, because a smaller and smaller fraction of the heat of combustion is available as the temperature rises.

Fig. 32 incidentally reveals the inherent inefficiency of high temperature furnaces. Vast quantities of fuel must be burnt to keep the furnace hot, even if no steel or other metal is heated. It may be argued that better heat insulation would reduce the fuel con-

*This is the minimum fuel consumption. Actual fuel consumption for keeping the furnace hot may be considerably greater than the minimum, if the path of the gases through the furnace is such that they do not readily give up their heat to the furnace walls, but pass out at a temperature considerably higher than that of the furnace.

Generated on 2024-09-08 14:06 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

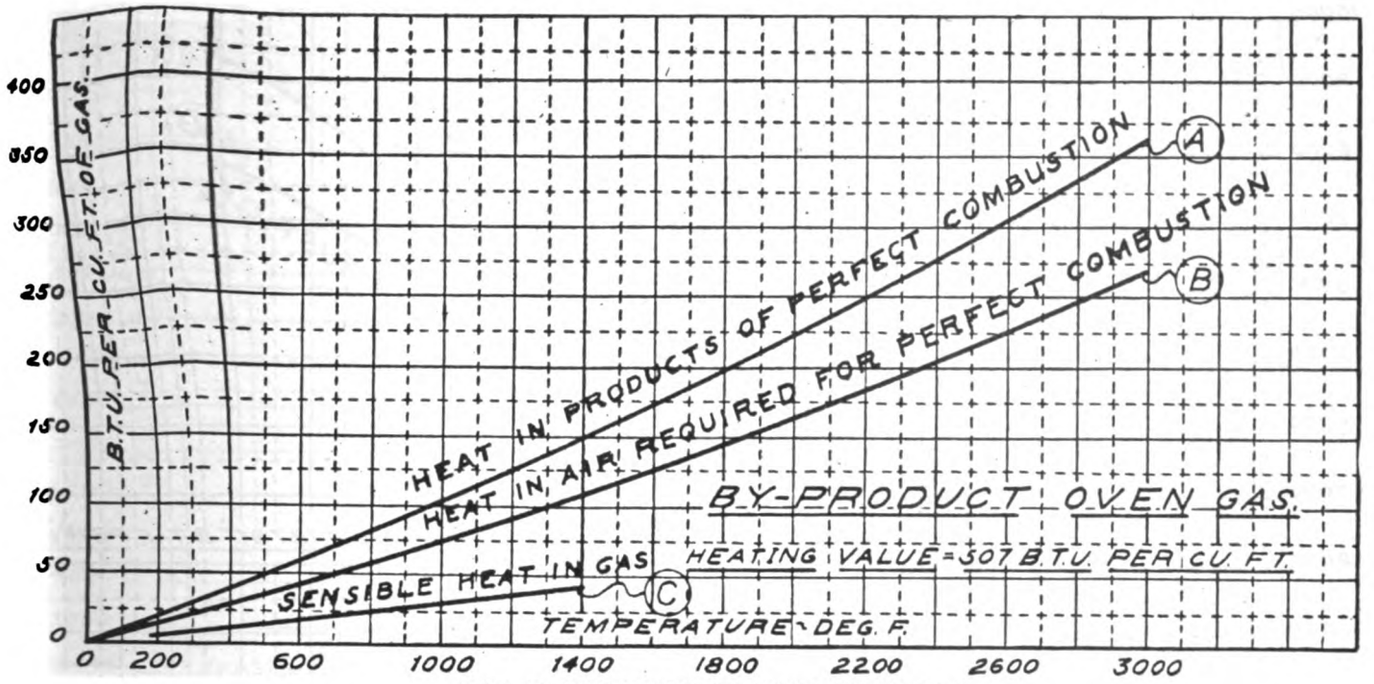


FIG. 26—BY-PRODUCT COKE OVEN GAS.

Analysis by Volume.

CO_2	.0075
CO	.0600
CH_4	.2815
H_2	.5300
N_2	.1210
	1.0000

Products of Perfect Combustion.
Pounds per cubic foot of gas.

CO_2	.043
N_2	.266
H_2O	.055

NOTE—All volumes are at 32° F. and 14.7 lbs. per sq. in. Abs. Density, .03071. Air required for perfect combustion, .333 lbs. per cu. ft. of gas.

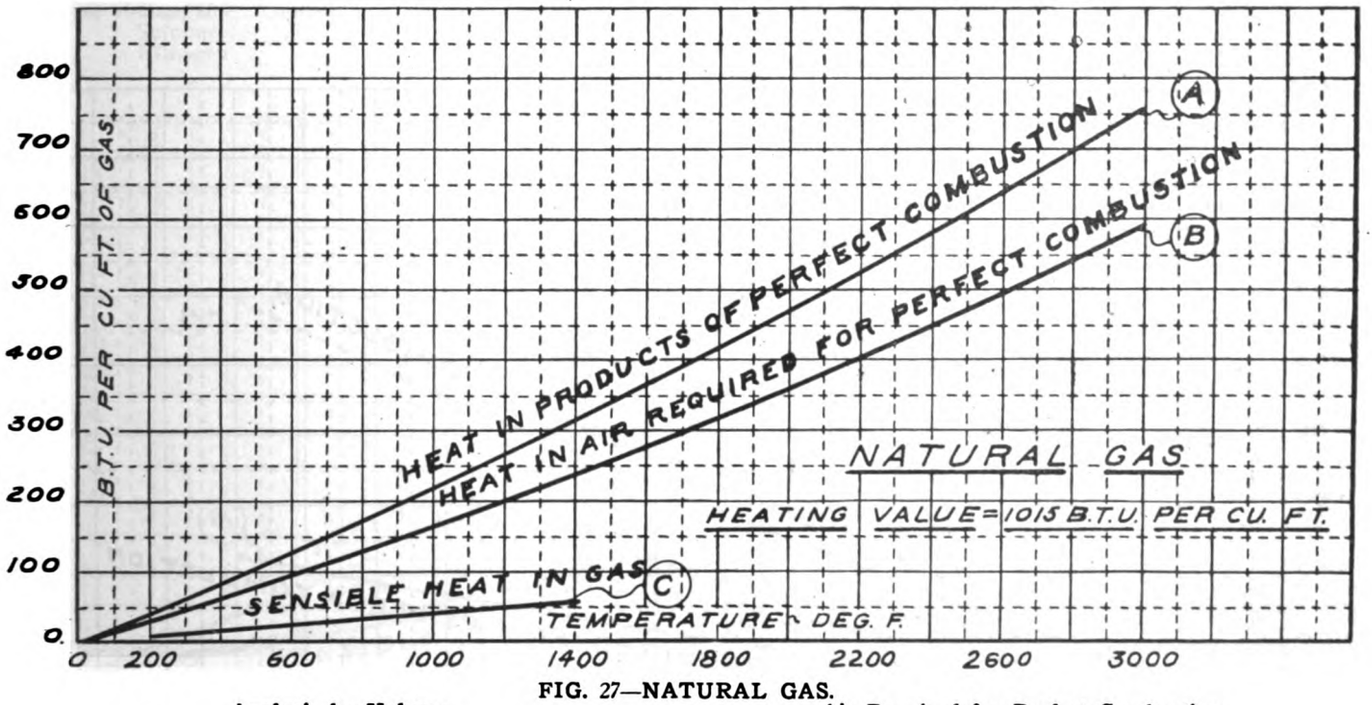


FIG. 27—NATURAL GAS.

Analysis by Volume.

CO	.0045
H_2	.0182
CH_4	.9333
C_2H_4	.0025
H_2S	.0018
O_2	.0035
CO_2	.0022
N_2	.0340
	1.0000

Air Required for Perfect Combustion.
.735 lbs. per cu. ft. of gas.

N_2	.5660
CO_2	.1174
H_2O	.0960

NOTE—All volumes are at 32 degrees F. and 14.7 pounds per square inch Abs. Density, .046058.

Generated on 2024-09-08 14:06 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

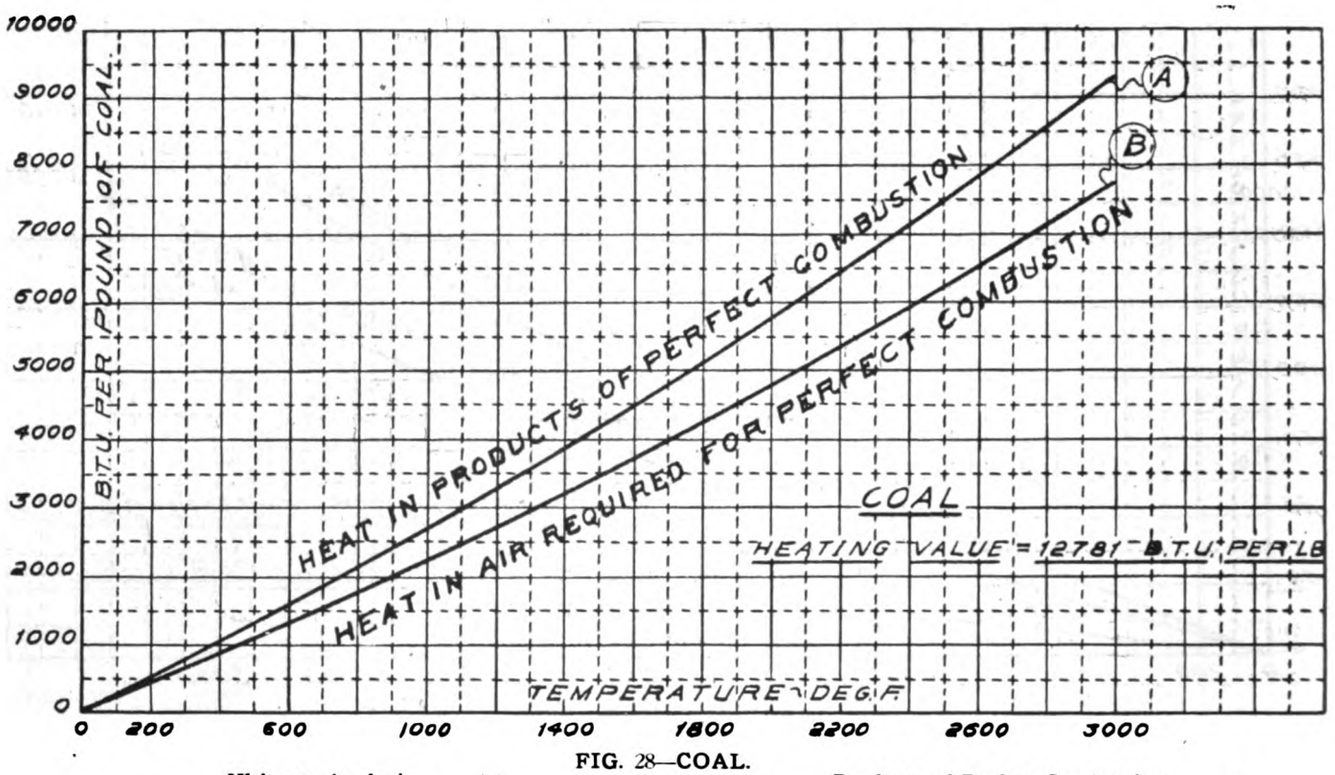


FIG. 28—COAL.

Ultimate Analysis.

Carbon	.70
Hydrogen	.05
Oxygen	.08
Sulphur	.02
Nitrogen	.02
Ash	.13
	1.00

Products of Perfect Combustion.
Pounds per pound of coal.

CO_2	2.61
N_2	7.34
H_2O	.45

Air required for perfect combustion = 9.53 pounds per pound of oil.

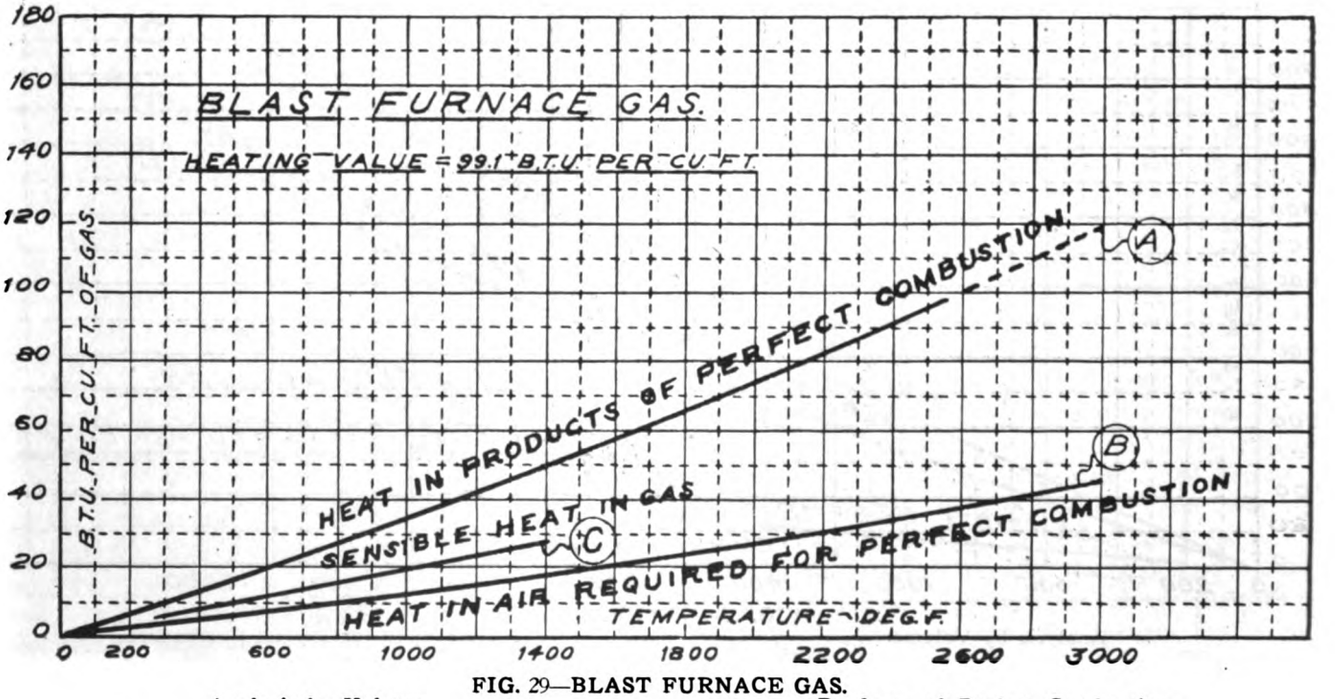


FIG. 29—BLAST FURNACE GAS.

Analysis by Volume.

CO_2	.1250
CO	.2540
H_2	.0350
N_2	.5860
	1.0000

Products of Perfect Combustion.
Pounds per cubic foot of gas.

CO_2	.0466
N_2	.0885
H_2O	.0018

NOTE—All volumes are at 32° F. and 14.7 lbs. per sq. in. Abs. Density, .08121. Air required for perfect combustion, .0556 lbs. per cu. ft. of gas.

Generated on 2024-09-08 14:07 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

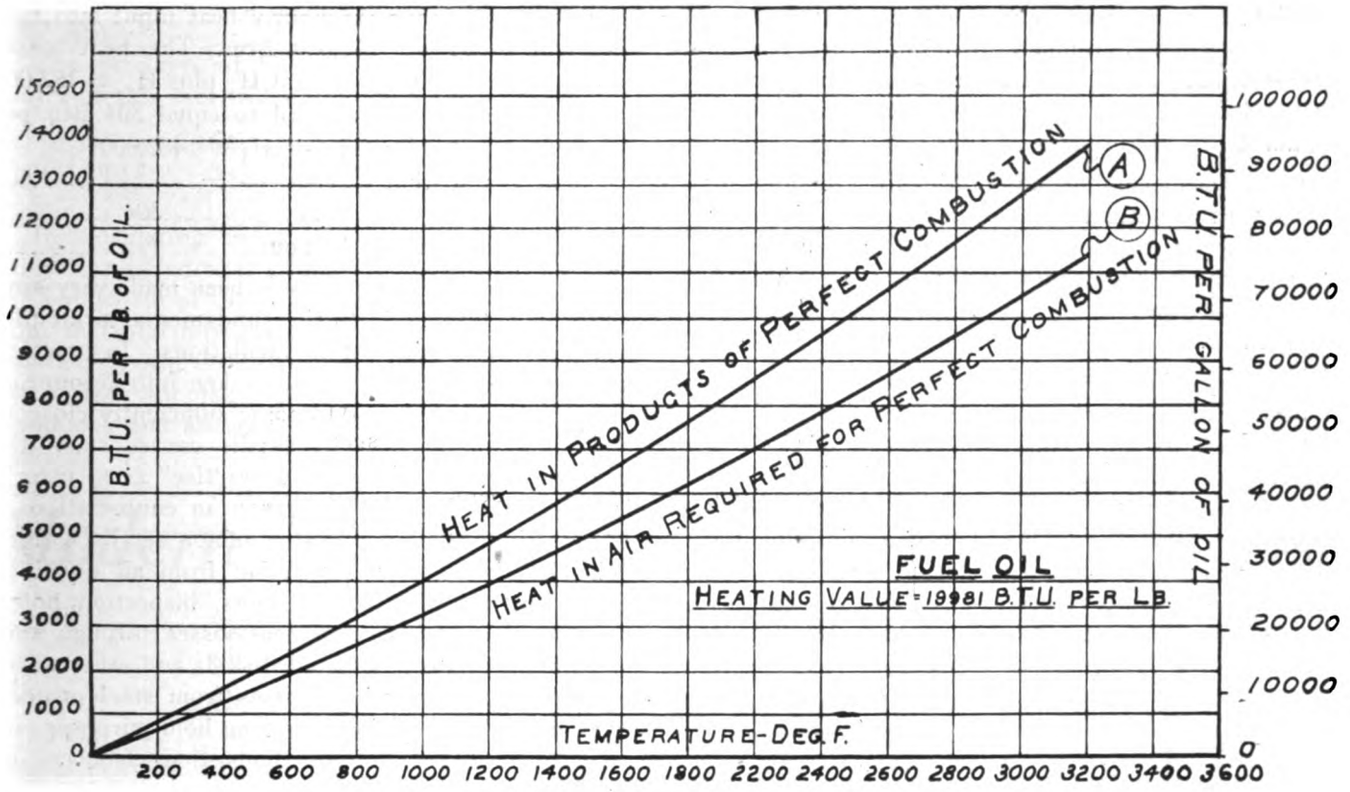


FIG. 30—OIL.

Ultimate Analysis.

Carbon	.840
Hydrogen	.127
Oxygen	.012
Sulphur	.004
Nitrogen	.017

Products of Perfect Combustion.
Pounds per pound of oil.

CO_2	3.088
N_2	10.800
H_2O	1.143

Air required for perfect combustion = 14.03 pounds per pound of oil.

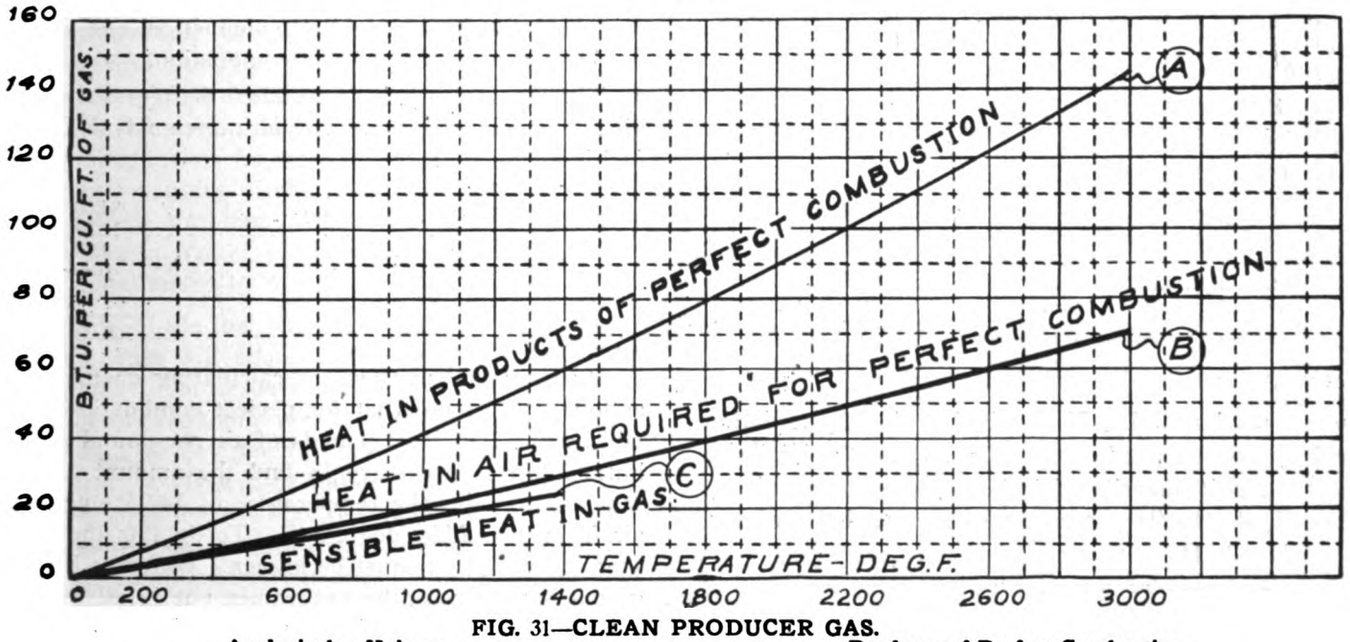


FIG. 31—CLEAN PRODUCER GAS.

Analysis by Volume.

CO_2	.0971
O_2	.0002
C_2H_4	.0019
CO	.1903
H_2	.1348
CH_4	.0278
N_2	.5479
	1.0000

Products of Perfect Combustion.
Pounds per cubic foot of gas.

CO_2	.0392
N_2	.1098
H_2O	.0101

NOTE—Volumes are at 32° F. and 14.7 lbs. per sq. in. Abs. Density, .07179. Air required for perfect combustion, .0876 lbs cu. ft.

Generated on 2024-09-08 14:05 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

sumption, but, unfortunately, the failing strength of refractories at high temperatures limits progress in that direction. Just how far we can go in practice, will be discussed later on in the chapters on strength and durability of furnaces.

Instead of discussing possibilities for economy, let us now turn our attention to plain every day furnaces in which no claims are made for economy, and let us determine the fuel consumption per ton of steel heated, because that information is usually demanded by the management.

Evidently, the fuel consumption per ton of steel (or other material heated) is a very elusive, variable quantity, because it is made up of the sum of the heat used for actually heating the steel and of the heat required to cover the heat losses. The heat which is stored up per hour in the steel depends upon the quantity of steel to be heated during each hour and upon the final temperature. It is easily found by means of the heat content curve, Fig. 3, see Part I. Let H_s be the heat imparted to the material being

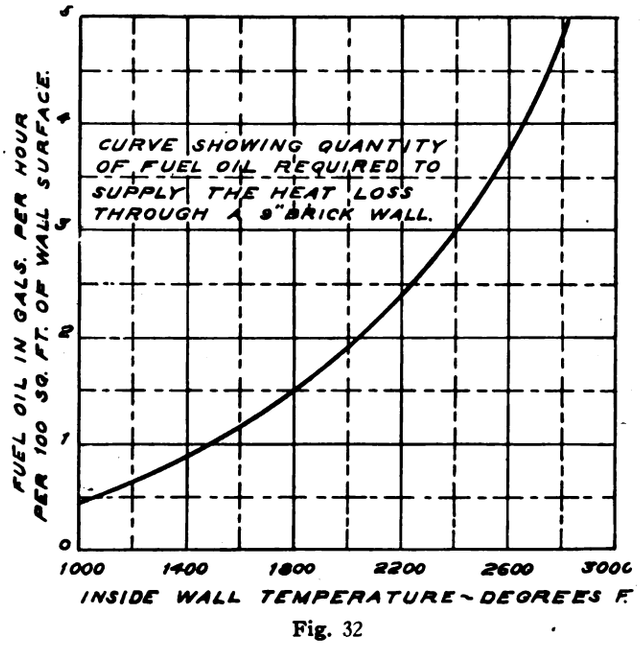


Fig. 32

heated per hour. Let H_1 be the heat lost by radiation and convection per hour, and let H_a be the available heat per unit quantity of fuel,

then $H_s + H_1 / H_a$ = quantity of heat needed per hour,

and $\frac{H_s + H_1}{H_s \times H_1}$ = quantity of fuel need for heating unit quantity of steel.

As an illustration, reconsider the furnace which was used as an example a few paragraphs above, and which required 631 cu. ft. of coke oven gas per hour to maintain the walls at 1,800 degrees F. Let 1,000 pounds of steel per hour be heated in that furnace to 1,800 degrees F, then the hourly heat input into that steel will be H_s = 290,000 Btu. The heat losses were H_1 = 192,000 Btu so that H_s plus H_1 = 482,000 Btu per hour. H_a was found to equal 304 Btu per cu. ft. of gas so that $\frac{H_s + H_1}{H_a} = \frac{482{,}000}{304} = 1{,}600$ cu. ft. of coke oven gas per hour.

The examples have purposely been made very simple so as not to becloud the fundamental principles with a multiplicity of detail calculations. In practice, these details positively must be taken into account, if the calculated values are to come sufficiently close to actual values. Neglect of details causes such discrepancy between "theory and practice" as to utterly discredit theory. For that reason an enumeration of the more important among the minor details will be advisable. They are: Radiation from all openings such as imperfectly closing doors, inspection holes, burner openings; increased heat losses through thin parts of walls, into water cooled skids and other water cooled furnace parts; heat losses from steel projecting through door openings for tong hold purposes; increase of heat losses from combustion chambers on account of their excess temperature compared to that of the furnace proper; heat losses from incomplete combustion (flame burning from around the doors).

Method of Calculating Heat in Flue Gases.

The following method was used in calculating the points for plotting the curves of the heat content in the air required for perfect combustion and in the products resulting from this combustion.

The points for fuel oil at 2,000 degrees F. will be given as an illustration. The ultimate analysis of this fuel is as follows:

Carbon	84.00
Hydrogen	12.70
Oxygen	1.20
Sulphur	0.40
Nitrogen	1.70
	100.00

By the usual methods of calculating chemical reactions, it is found that for perfect combustion there will be required 14.03 pounds of air per pound of fuel burned. It is necessary to find the amount of heat required to raise the temperature of 14.03 pounds of air from 0 to 2,000 degrees F. To do this the mean specific heat of air must be known. Different investigators have given different values but in all the calculations for the heat in the air required for perfect combustion, the equation given by Upton was used which is as follows: Mean specific heat at constant pressure from 0 to t degrees F. = .237 + .000011t. Using this equation, the mean specific heat between 0 and 2,000 degrees F. is .259. The heat in the air required for perfect combustion of one pound of fuel

Generated on 2024-09-08 14:03 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

at 2,000 degrees F. is then .259 × 2,000 × 14.03 = 7.267 Btu.

The products of the perfect combustion of one pound of this fuel will be as follows:

Carbon dioxide	3.088 pounds
Nitrogen	10.800 pounds
Water vapor	1.143 pounds

In calculating the above values, the sulphur di-oxide was added to the carbon di-oxide and the nitrogen equivalent of the oxygen in the fuel was deducted from the total nitrogen. The mean specific heats at constant pressure of the products of combustion are taken from the table given on page 367 of Mark's Handbook and are as follows for from 0 to 2,000 degrees F.

Carbon dioxide	.2617
Nitrogen	.2650
Water vapor	.5683

The heat required to raise the temperature of the carbon dioxide from 0 to 2,000 degrees F. is .2617 × 3.088 × 2,000 = 1,616 Btu.

The heat required to raise the temperature of the nitrogen from 0 to 2,000 degrees F. is .2650 × 10.8 × 2,000 = 5,730 Btu.

The heat required to raise the temperature of the water vapor from 0 to 2,000 degrees F. is .5683 × 1.143 × 2,000 = 1,300 Btu.

The heat required to raise the products of perfect combustion of one pound of fuel from 0 to 2,000 degrees F. is the sum of 1,620 + 5,730 + 1,300 = 8,650 Btu.

Modern Steam Power Station Equipment

Reviewing Modern Steam Power Plant Equipment Installed to Meet Demand of Increased Power Facilities—Correct Installations, Good Supervision and Correct Operation Necessary for Results.

By JOSEPH G. WORKER,
Manager Stoker Section Westinghouse Electric & Manufacturing Co.

War necessities brought about to a certain degree, "conventional" steam power plants. The activities of the different government administrations, however, have exacted requirements, in detail, conducive to the highest economic operating results. Production, on the one hand, has made the different public service corporations face the necessity of increased power facilities, and the requirements of fuel conservation, on the other, have demanded a careful study of detail problems, not only in the selection of equipment, but in providing means for its economical operation. The coöperative activity of the power plant management, with all these problems, cannot be better exemplified than in the character of the equipment designed for recent installations of new steam plants.

A study of the fuel burning equipment of the most modern plants will show that every consideration is being given to those details which provide for a balancing of the economic results that come from a careful selection of equipment, good supervision and correct operation. It will be found that elaborate means are being provided so that the boiler room organization can do things easily. It is no longer necessary for firemen to climb ladders and crawl over the boiler tops to change the position of dampers, although such methods are still common in many old plants. Mechanisms are being placed at the hands of the operators so that it is not necessary for them to go to inconvenient places in order to control operating conditions.

The most generally used fuel burning equipment in the modern stations is the "inclined multiple retort" underfeed stoker, designed for large boiler units, ranging from 1,200 to 1,500 hp. A number of boilers containing 12,600 sq. ft. of heating surface have been used and are furnishing steam for 7,000 to 8,000 kw in the prime mover. It is not at all improbable that this unit will be further developed to furnish steam for at least 10,000 kw, in the prime mover for continuous operation. These units are set singly with large alley ways between each setting, so that the boiler and fuel-burning equipment are accessible on all sides. The stokers are designed for a flexible operation of 50 to 300 per cent rating. Clinker grinders are used in a number of cases for discharging the ash and refuse automatically.

The following brief description of the fuel-burning equipment recently installed in a number of modern power stations covers a wide range in the character of load and fuel used. Some of these plants are completely new stations, while other are extensions to old stations, and still others are old stations in which inadequate fuel-burning equipment has been replaced by more modern equipment.

Edison Electric Illuminating Company of Boston.

This company has replaced old fuel-burning equipment under eight 512 horsepower boilers with inclined underfeed stokers. One of these stokers was equipped with a clinker grinder, the idea being to try this out under regular operating conditions and with the fuel available, this being a part of a study for the new ex-

Generated on 2024-09-08 14:05 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

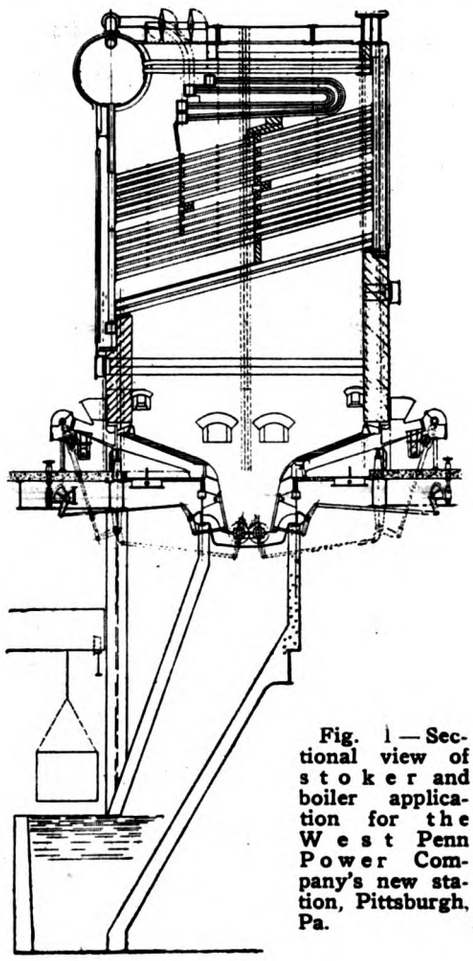


Fig. 1—Sectional view of stoker and boiler application for the West Penn Power Company's new station, Pittsburgh, Pa.

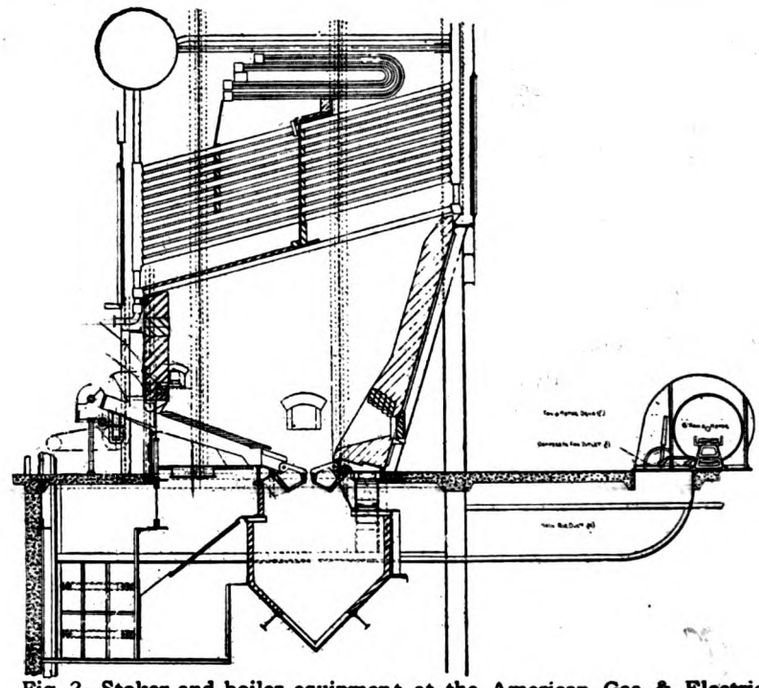


Fig. 2—Stoker and boiler equipment at the American Gas & Electric Co. plant.

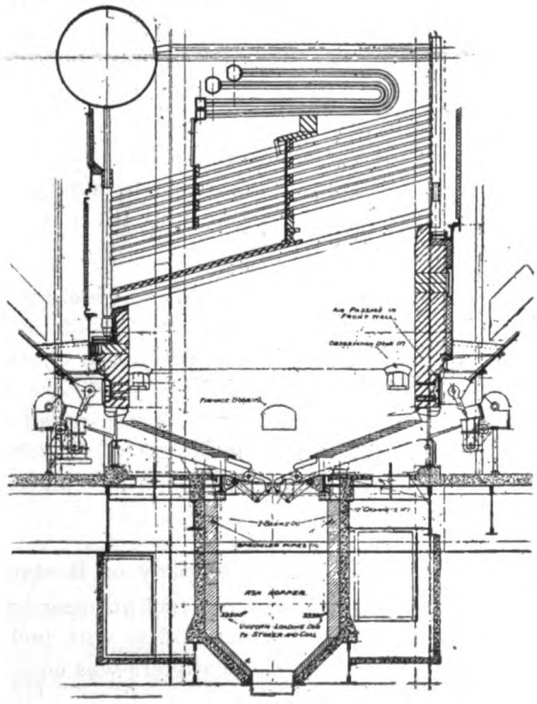


Fig. 3—Setting of Buffalo General Electric stokers.

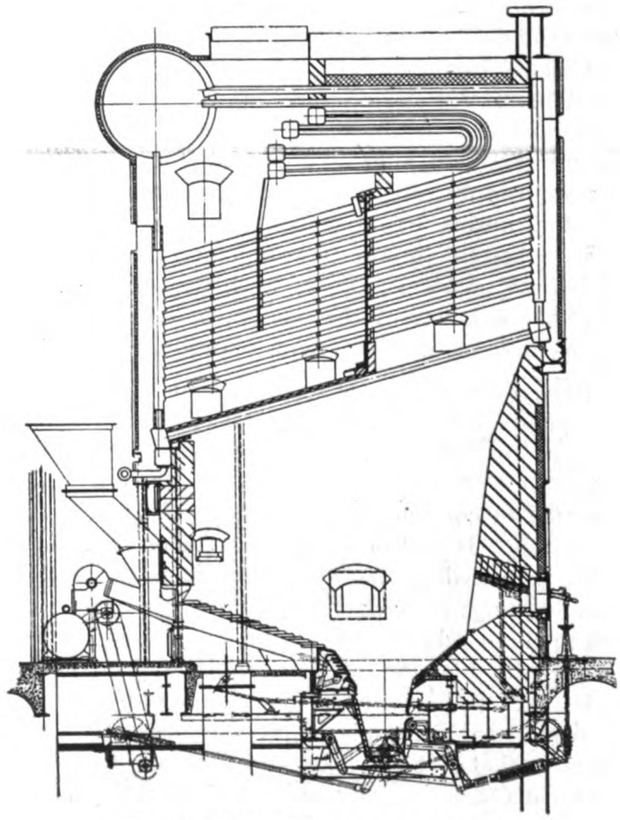


Fig. 4—Boston Edison works setting.

Generated on 2024-09-08 13:59 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

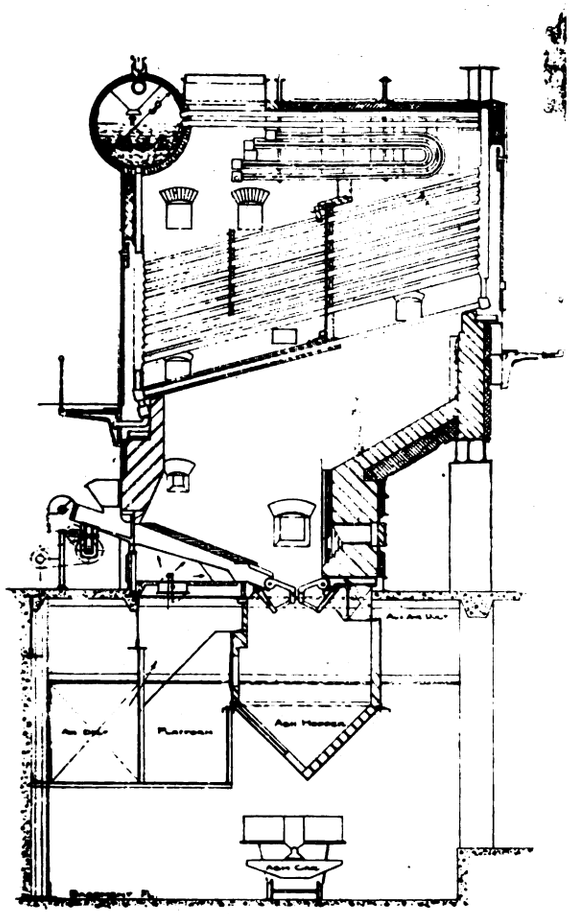


Fig. 5—Stoker and boiler application of the Union Gas & Electric Co., Cincinnati.

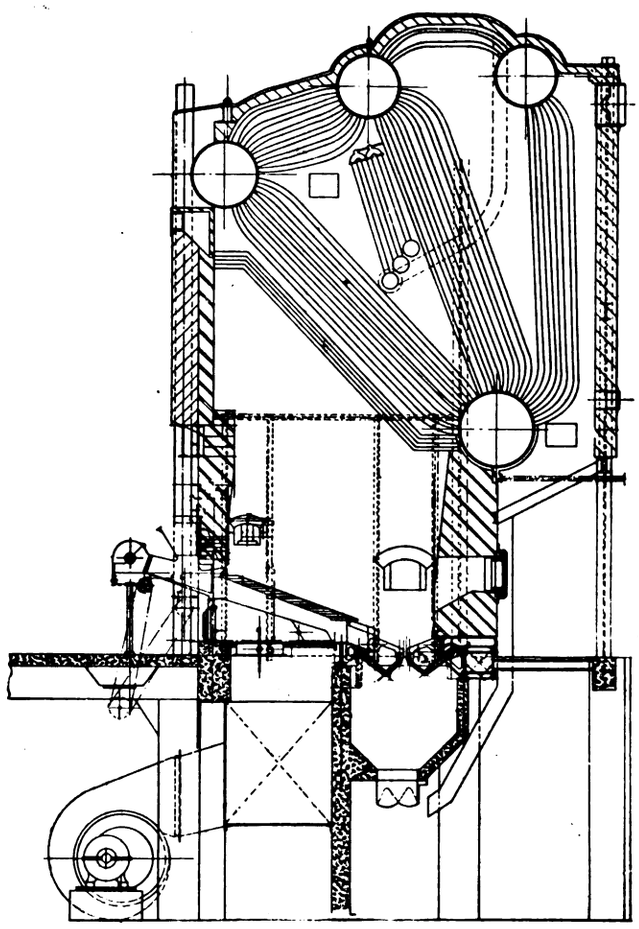


Fig. 6—Side elevation of boiler and stoker application in the Denver Gas & Electric Co. plant, Denver, Col.

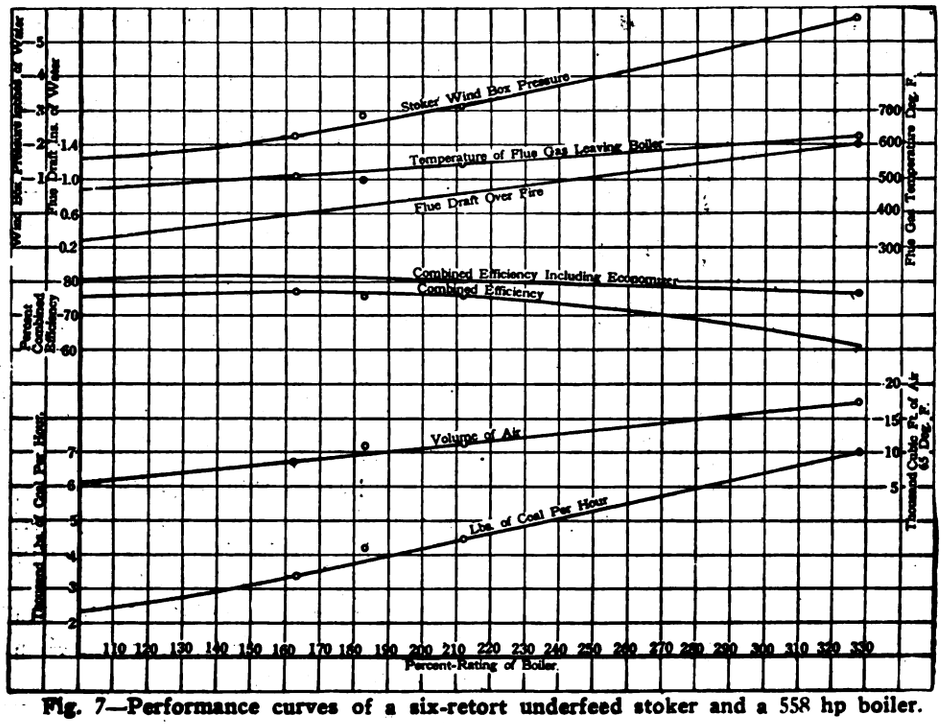


Fig. 7—Performance curves of a six-retort underfeed stoker and a 558 hp boiler.

Generated on 2024-09-08 13:59 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

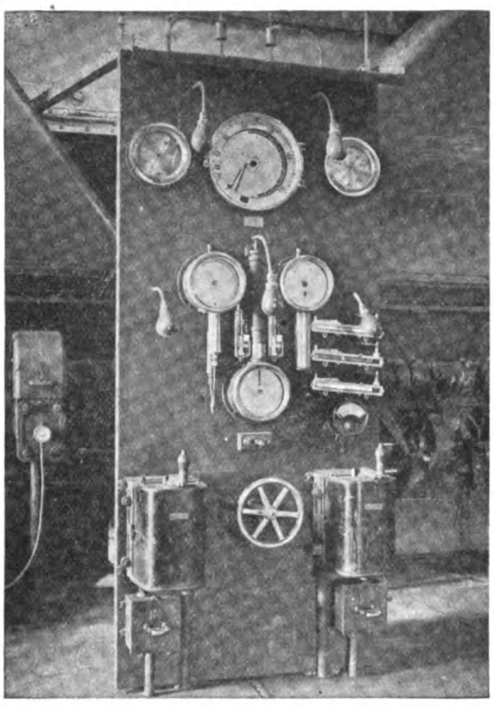


Fig. 8—Instrument board at the Delray station.

tension to the station. Although the stoker was of small size (five retorts), the clinker grinder operated satisfactorily and it was decided to use this design in connection with the equipment for the new extension consisting of four cross-drum boilers, 42 sections wide, 14 tubes high and 18 ft. long, rated at 1,232 hp., at 300

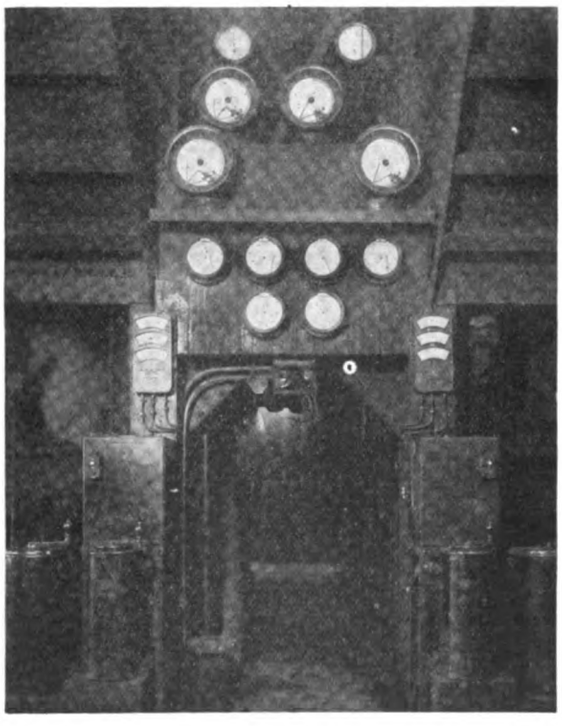


Fig. 9—Instrument board used in connection with the stokers and boilers shown in Fig. 2.

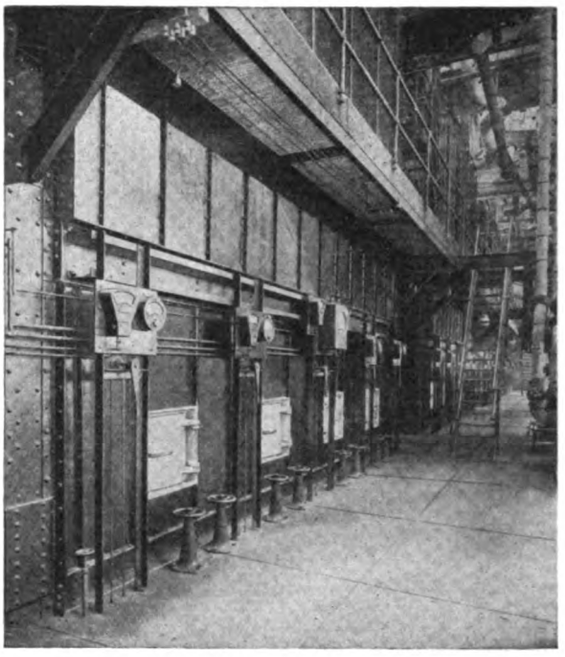


Fig. 10—Rear view of Boston Edison boiler.

pounds gauge pressure equipped with a superheater designed to give 150 degrees superheat.

These stokers, as shown in Fig. 4, are of the underfeed type, having 13 retorts installed under the back end of the boiler, under the mud drums, and equipped with rotary clinker grinders, Fig. 13, for removing the ash and clinker continuously. The stoker drives Fig. 11, are divided with not over four retorts to a motor; also, the wind boxes and dampers are so arranged that they can be controlled on the same basis, this provision being made so as to give a complete control of coal and air across the entire furnace width.

The coal usually used is New River, of approximately the following analysis:

Fixed carbon	73.50
Volatile	20.75
Ash	5.75
Moisture	3.25
Sulphur	1.05
Btu	14,700

The average per cent of combustible in the ash and refuse is not to exceed 15 per cent. The stoker equipment, when supplied with the above fuel, is designed to develop 300 per cent of normal rating of the boilers for periods of short duration.

The Boston Edison engineers worked out a design in which doors are placed in the bridge wall and all controlling mechanism placed at the end opposite the stoker, Fig. 10, so that when the operator views the furnace fires through the bridge wall doors, he will have at hand the controlling mechanism.

Buffalo General Electric Company.

The fuel-burning equipment for a recent extension

Generated on 2024-09-08 14:28 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

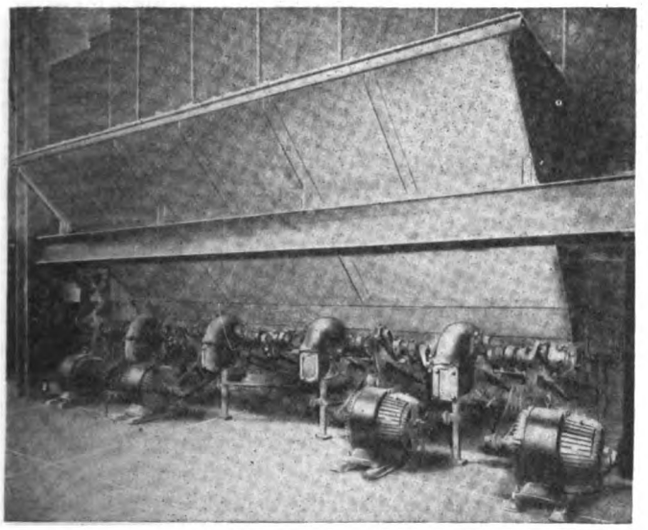


Fig. 11—Front view of Boston Edison stokers.

of this company's boiler plant consists of 24-retort underfeed stokers applied to 1,140 hp cross-drum boilers, Fig. 11. The stoker equipment is designed for burning high volatile Pittsburgh coal of about 13,500 Btu as fired, 10 per cent ash, 3 per cent moisture and 2 per cent sulphur. Air admitting dump grates are furnished with the stoker equipment, these being power-operated. To eliminate, as much as possible, the formation of clinker, air boxes were designed for installation in the side wall. The combined efficiency for the plant's operating conditions will range from 75 per cent at 200 per cent of boiler rating, to 65 per cent at 500 per cent of boiler rating. The coal burning equipment is designed for continuous capacity of 480 per cent of boiler rating and 600 per cent for short durations. In comparison, this boiler has 24 retorts installed under an 1,140 hp boiler, while at the Delray Station of the Detroit Edison Company, there are 26 retorts installed under a 2,365 hp boiler.

Union Gas & Electric Co., Cincinnati.

The new $8,000,000 plant of this company contemplated the installation of eight cross-drum type boilers containing approximately 12,625 sq. ft. of water heating surface, with superheaters to produce 250 degrees superheat. Each boiler was made up of 42 sections each, 13 tubes high and 20 ft. long, the furnace width being 24 feet inside the setting walls. Each boiler is equipped with economizers over the boiler and each boiler, with its economizer, is designed for evaporating 100,000 pounds of water per hour continuously from 100 degrees to steam at 250 pounds pressure, and superheated 250 degrees, Fig. 5. The entire equipment is capable of evaporating 120,000 of water under the same conditions for short periods. The fuel-burning equipment is designed for burning West Virginia coal from the Kanawha district, containing approximately 12,500 Btu per pound as fired.

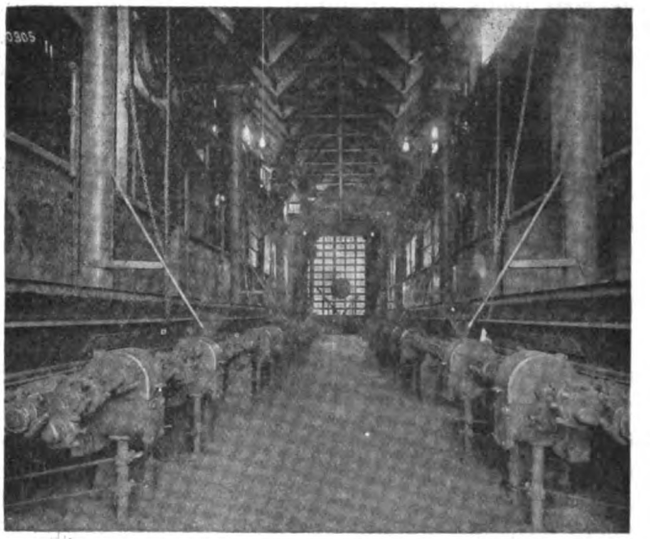


Fig. 12—Underfeed stoker equipment of the Minneapolis General Electric Company, Minneapolis, Minn.

The stoker equipment is of the underfeed type, each stoker containing 14 retorts placed under the rear of the boiler under the mud drum. The stokers consist of double dumping grates with arrangements for admitting air to them. The fuel-burning equipment is designed for combined efficiency ranging from 75 per cent, with a boiler capacity of 35,000 pounds of water, to 65 per cent with a capacity of 100,000 pounds of water. Each stoker is driven independently by direct-current motors connected by Morse silent chain drives to the line shaft of the stokers. Instrument boards are installed to indicate to the operators the exact furnace conditions.

American Gas & Electric Co., Windsor, W. Va.

The $10,000,000 plant of this company, located in

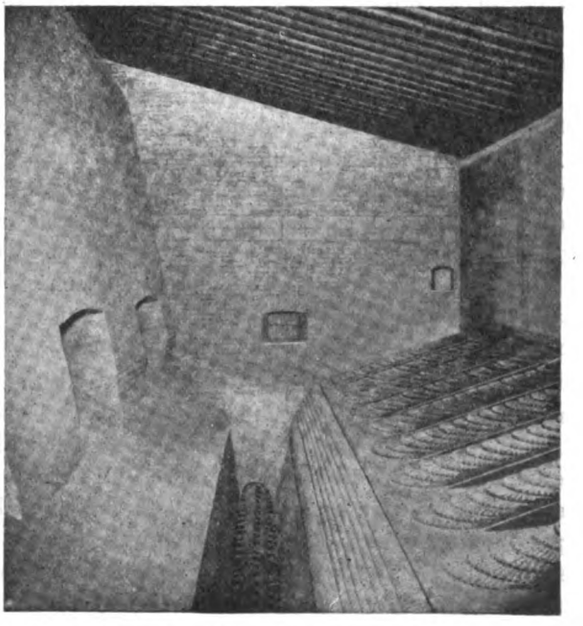


Fig. 13—Interior view of Boston Edison stokers.

Generated on 2024-09-08 14:00 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

the coal fields of Pittsburgh, is one of our largest power plant developments of recent years. The present boiler-room equipment, either installed or provided for, consists of 14 boilers with underfeed stokers similar to the equipment mentioned for the Union Gas & Electric Co. The setting of the stokers is shown in Fig. 2, and the instrument boards, as shown in Fig. 9, are placed between each boiler in the aisles.

Detroit Edison Company.

The boiler and stoker equipment installed at the Delray plant of the Detroit Edison Company consists of 2,365 hp boilers equipped with 26-retort underfeed stokers, with clinker grinders. The Detroit Edison Company engineers have done considerable work in the development of these clinker grinders. Difficulty was at first experienced on account of the fuel bed breaking, where the fuel left the underfeed part of the stoker, and going into the ash well. The grate surface has been curved, this being done in order to eliminate the breaks in the fire. This equipment is run ordinarily at about 150 per cent of boiler rating, but higher capacities can be obtained when necessary. The coal used contains about 13,200 Btu as fired, and 10 per cent ash. Under the above operating conditions, the combustible in the ash runs from 14 to 18 per cent.

The instrument board used for indicating to the operators the condition of the furnace is shown in Fig. 8. It will be noted that everything possible is provided to facilitate ease in handling the controlling equipment.

West Penn Power Company, Pittsburgh, Pa.

The new plant of the West Power Company, on the Allegheny river above Pittsburgh, contemplates some decidedly novel features in the boiler and stoker equipment. The initial installation is designed for six boilers of the cross-drum vertical-header type, 42 sections wide, 16 tubes high, 20 ft. long, set with the front header 16 ft. above the floor, each boiler being rated at 1,529 hp and equipped with superheaters designed to give 200 degrees superheat. Underfeed stokers are to be installed at the front and rear ends of the boilers, Fig. 1, 14 retorts under the mud drum, and 14 retorts under the front of the boiler. The operating conditions are to be a maximum of 300 pounds gauge pressure, 200 degrees superheat.

The boilers will be set in two rows with aisles about 15 ft. between, thus giving plenty of room around each boiler for proper operating facilities. The stoker drives are so divided that there will be 7 or 14 retorts driven by one prime mover, and the wind box dampers are arranged to control separately the air for units for three or four retorts. The stokers are to be equipped with clinker grinders for continuously removing the ash and clinker. Pittsburgh coals will be used with approximately the following analyses:

	Coal "A"	Coal "B"	Coal "C"
Fixed carbon	57.38	49.96	56.55
Volatile	34.81	32.84	32.80
Ash	7.81	13.26	10.10
Moisture	5.52	0.94	0.55
Sulphur	1.50	1.20	0.79
Btu (as fired)	13,500	11,748	12,713

The boiler equipment is designed so that the flue gas temperatures will range from 500 degrees at 150 per cent rating to 700 degrees at 300 per cent rating, the combined efficiency ranging from 75 per cent at 150 per cent rating, to 65 per cent at 350 per cent rating. Each stoker, when burning fuel as mentioned above, is designed to develop 350 per cent of boiler rating continuous with the clinker grinder in operation, and 400 per cent of boiler rating for peaks of short duration. Under these operating conditions, the combustible in ash is not to exceed 14 per cent, and the ash is to be discharged into water-sealed ash pits.

Minneapolis General Electric Company.

The engineers for H. M. Byllesby Company have been very active in redesigning the fuel-burning equipment of plants under their management. For example, at the Minneapolis General Electric Company's plant, Fig. 12, there were installed 12 underfeed stokers under 12 600 hp boilers. A recent extension to this plant contemplates the installation of five 14 retort underfeed stokers under five 1,300 hp boilers. On account of the coal conditions prevailing at this plant, it was necessary to design equipment for two grades of coal of the following proximate analyses:

	Coal "A"	Coal "B"
Fixed carbon	56.48	43.49
Volatile	30.81	32.59
Ash	11.03	20.44
Moisture	7.00	10.00
Sulphur	1.70	3.48
Btu	13,400 dry	11,200 dry

Under the above conditions, the operating performance of fuel "A" ranged from 1,800 to 3,000 hp continuous and 4,500 hp for short durations. With the poorer grade of coal, the maximum capacity was reduced to 3,000 hp for short durations.

Union Electric Light & Power Co., St. Louis.

In the past year or so, the boiler plant of the above company, has been entirely revamped and a change made in the type of fuel-burning equipment formerly used. Careful study was made in regard to the installation of stokers, and it was finally decided to install underfeed stokers for use with good Illinois coal of the following analysis:

Fixed carbon	48.9
Volatile	27.3
Ash	14.9
Moisture	8.9
Btu (as fired)	11,112

The main problem at the start was that of designing the equipment to eliminate, as much as possible, trouble due to clinker formation on the side walls. After the equipment was in operation, and when using

(Continued on page 202.)

Generated on 2024-09-08 14:02 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

Rolling Mill Research Laboratory Founded

Experimental Rolling Mill and Bureau of Rolling Mill Research, Organized in Pittsburgh by Leading Steel and Rolling Mill Manufacturers Under the Auspices of Carnegie Institute of Technology.

The decision of a number of officials of the leading steel and engineering companies manufacturing rolling mill machinery, to install an experimental rolling mill and bureau of rolling mill research under the auspices of the Carnegie Institute of Technology at Pittsburgh, marks not only the beginning of a radical advance in the art of rolling steel and other metals in this country, but an equal advance in the spirit of coöperation among American manufacturers which the industrial leaders have long striven to obtain, and which they recognize as absolutely necessary if this country is to retain its industrial supremacy during the coming period of reconstruction. This bureau of rolling mill research will have four distinct functions:

1. To investigate and study the physical and mechanical changes taking place in steel and other metals, and the power consumed, during the process of being rolled at various temperatures and speeds.

2. To distribute the information obtained by means of these experiments among the coöperating firms in order that they may put it into commercial use.

3. To provide laboratory facilities in which the contributing companies may conduct experiments and investigate designs of rolls for the production of new sections which they wish to place on the market.

4. To offer courses of instruction to students employed by the contributing interests and to those students who are to specialize in this field and are registered at the Carnegie Institute of Technology.

As planned at present the mill will consist of three stands of three high rolls driven by a 500 hp variable speed electric motor. The drive and change speed gears will be so arranged that any number of revolutions between 4 rpm and 1,000 rpm may be obtained. This wide range of speeds will enable a careful study to be made of the effects of speed on power consumed, and physical properties of the steel when rolled and treated under varying conditions.

Both the mill and the drive will be equipped with a complete set of automatic recording instruments and changes in their readings under the varying conditions of rolling will be recorded. The special stand for measuring the spreading force on rolls is to be equipped with hydraulic cylinders so arranged that the work done to overcome friction at the roll necks is automatically separated from the work done in rolling the steel.

Another feature of the mill will be a quick action stop clutch. By means of this clutch the mill may be instantly stopped while a bar is passing through the rolls.

In practical mill work a roller often has to wait days and sometimes weeks before he can catch this condition, as he could not consider the stopping of production while he made a cobble in some particular roll pass that was giving him trouble, and it is mainly by studying the cobbles that the action of the steel can be observed and studied.

By stopping the mill and catching a bar in the rolls the exact action or flow of the steel in that particular pass and with the particular set of conditions under which the mill is operating, will be permanently recorded in the section of bar being pinched by the rolls.

The rolls will then be opened and the bar withdrawn and studied. By this means a student can gain more experience in the rolling of steel and knowledge of the flow of steel during rolling in one year on the Tech mill than could possibly be gained in many years work on a commercial mill.

The stopping of the rolls and withdrawal of the cobble requires considerable time and would interfere so seriously with the production of a commercial mill that it is only on very rare occasions when the demands are absolutely imperative that such experiments are run. On these rare occasions there are seldom more than a few employes immediately connected with the work on hand to witness the trials and the results are usually very carefully guarded.

The number of experiments which may be run on the experimental mill and the number of students attending will only be limited by time and the size of the laboratory.

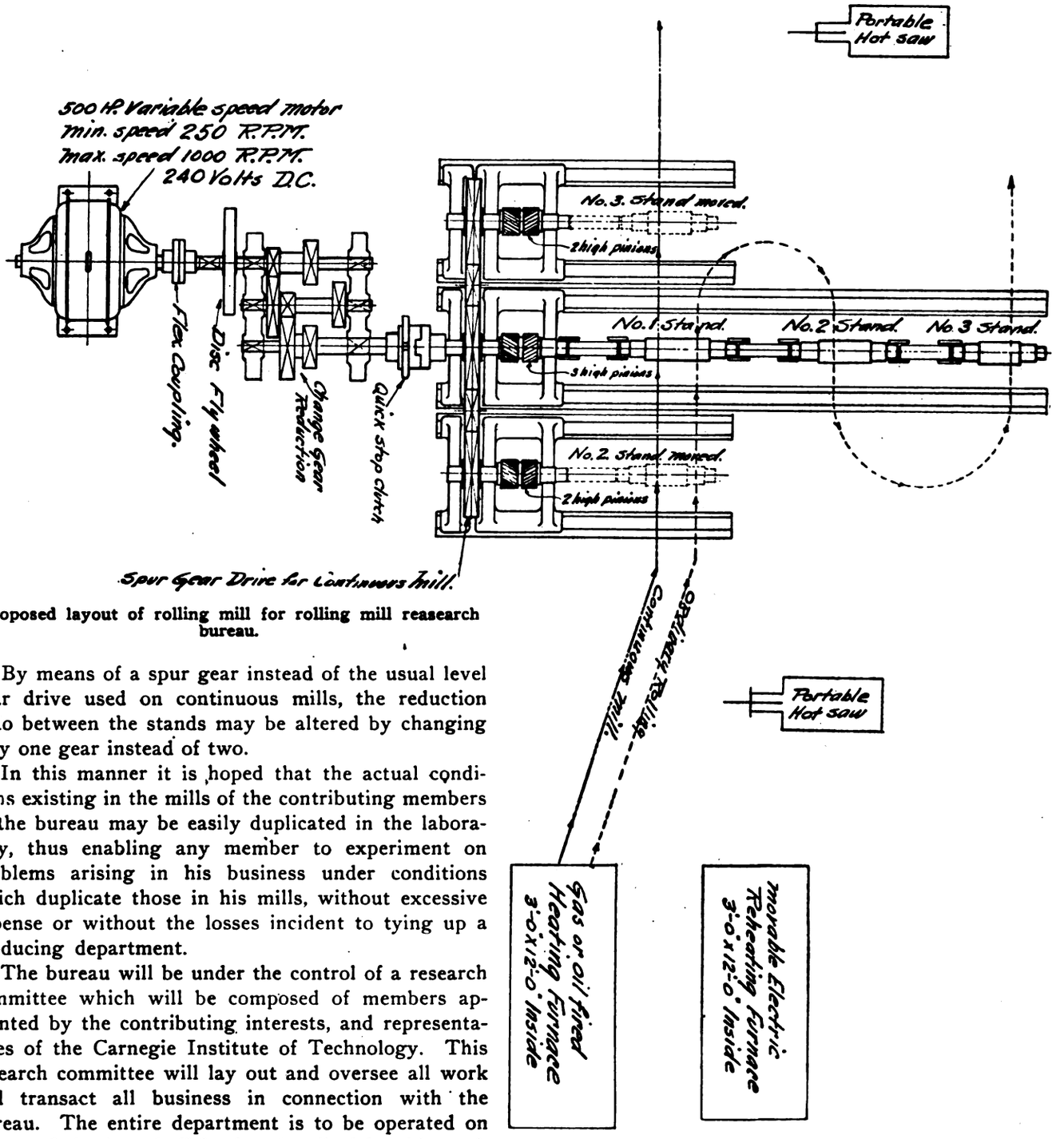
It is also the intention to instruct these students just as carefully in what not to do as in what to do. Many experiments will be run which are carefully planned to fail and illustrate the common causes of faulty product in commercial mills.

The accompanying sketch shows a diagramatic layout of the mill and drive. As will be seen the three stands may be mounted on one shoe and used as a Belgian train with No. 1 stand as a rougher, No. 2 stand as strand or leaders, and No. 3 stand as finishers; No. 2 and No. 3 stands may be moved as indicated in dotted lines so that all three housings are placed in tandem and the mill will operate as a continuous mill.

When operating in this manner only the two upper rolls would be used, the lower ones being left out and

Generated on 2024-09-08 14:02 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

the space for their neck bearings filled up. In order to drive the continuous mill a train of spur gears is located just outside the pinion housings, the large driving gears being mounted on an extension of one of the pinion necks. Idle gears between are carried by separate adjustable bearings.



Proposed layout of rolling mill for rolling mill reasearch bureau.

By means of a spur gear instead of the usual level gear drive used on continuous mills, the reduction ratio between the stands may be altered by changing only one gear instead of two.

In this manner it is hoped that the actual conditions existing in the mills of the contributing members of the bureau may be easily duplicated in the laboratory, thus enabling any member to experiment on problems arising in his business under conditions which duplicate those in his mills, without excessive expense or without the losses incident to tying up a producing department.

The bureau will be under the control of a research committee which will be composed of members appointed by the contributing interests, and representatives of the Carnegie Institute of Technology. This research committee will lay out and oversee all work and transact all business in connection with the bureau. The entire department is to be operated on a no profit basis and all funds subscribed for this work and not used, will be returned to the subscribers.

It is believed that the bureau has a big future before it and that a great number of problems are awaiting solution. Several manufacturers of furnaces and rolling mill machinery have already asked permission to install in the new laboratory parts of the required apparatus which they manufacture, free of charge.

Among the many problems where research work can be done and on which more information is badly needed by rolling mill engineers, are:

(A) Separating forces acting on rolls and housings.

(B) Influence of speed on separating forces and on roll train resistance.

(C) Ratio of roll neck friction to total roll train resistance.

Generated on 2024-09-08 14:02 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

(D) Influence of roll diameter, steel temperature, roll velocity and form of projected contact area on spreading.

(E) Greatest deformation which plastic material can undergo without injury, while being rolled.

It is planned to demonstrate to students who are studying rolling mill engineering and roll pass design the following phenomena:

(1) Effects of separating or closing the rolls.
(2) Effects of "crossing" the rolls.
(3) Metallurgical effects of many light passes.
(4) Metallurgical effects of a few heavy passes.
(5) Rolling of shapes, and merchant material.
(6) Study of plastic deformation and lines of flow.
(7) Forward slippage in rolling.

It would be difficult indeed to find a rolling mill manager who would be willing to disrupt his rolling program and carry on such a line of experiments as has just been outlined. A moment's reflection however will convince even a layman that if this country is to maintain its industrial supremacy in steel it must produce its quota of skilled steel works engineers. In the past the roll pass designers have gotten their information in little bits, here and there, some of which was accurate and some was not. The designer would have no way of finding out until sad experience and costly delays would point the way.

This proposed experimental mill will be the only one of its kind in the world. The Carnegie Institute of Technology will be the only school in the world where a man can go and find a prescribed course of study in the design of roll passes laid out in natural, logical steps where he may study the theories proven by a carefully arranged set of experiments and demonstrations.

This bureau will be under the able direction of W. B. Skinkle who has had wide experience in both the design and operation of rolling mills and rolling mill machinery. Mr. Skinkle was engineer of the shell department at the Neville Island arsenal. Just prior to that he was chief engineer of the Schoen Works of the Carnegie Steel Company. He has also been connected in engineering capacities with the Homestead and Edgar Thompson plants of the Carnegie Steel Company, Julian Kennedy, United Engineering & Foundry Co., Mackintosh-Hemphill, and the Lewis Foundry & Machine Co., of which concern he was chief engineer.

New Dry Cleaner for Blast Furnace Gas

Kling-Weidlein Dry Gas Cleaner Developed at Youngstown Claims Many Advantages Over Wet Process—Sensible Heat of Gas Is Retained—Greater Steam Generation and Higher Stove Temperature.

By J. C. BARRETT,
Superintendent of Blast Furnaces, Carnegie Steel Company, Youngstown, District.

Realizing the inefficiency of the various methods of cleaning and burning blast furnace gases, F. E. Kling, chief mechanical engineer, and Luther B. Weidlein, experimental engineer of the Ohio Works, Carnegie Steel Company, Youngstown, Ohio, five years ago started experiments to overcome the difficulties.

In the course of their experiments, they developed a very efficient gas burner for boilers, which is truly an aspirating burner and fulfills the rigid specifications required for burning blast furnace gas efficiently.

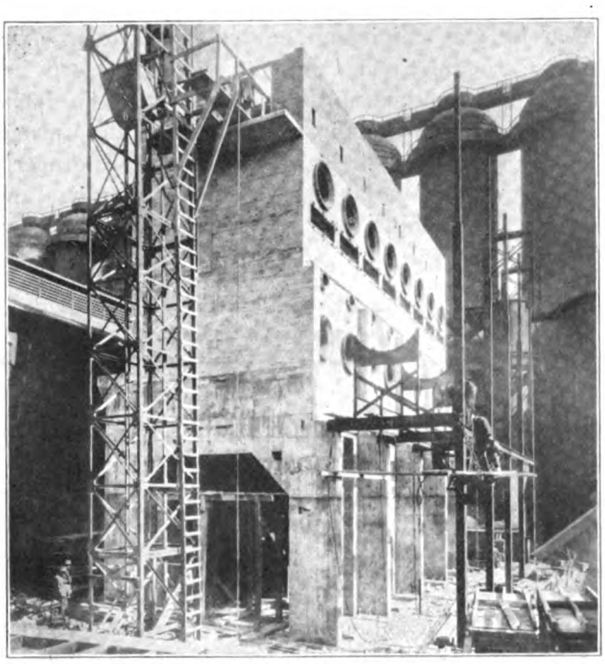
After completing this phase of the problem, steps were taken to make a comparison of results obtained from burning gas which had been cleaned or partly cleaned by various means, and dirty gas taken directly from the dust catcher.

The first experiment was carried out with gas that had passed through an impinging type of wet washer. This type of washer was found to be very inefficient as it reduced the temperature about 50 per cent, was not more than 50 per cent efficient in removing the dust, and the gas picked up about 15 per cent additional moisture. The item of reduced temperature alone was sufficient to condemn this method, disregarding the high dust content of the gas. Aside from the loss of the sensible heat due to reduced temperature and increased moisture content of the gas, the quantity of dust which the gas carried through the washer was just as detrimental to obtaining boiler and hot blast stove efficiency as if the gas had not been cleaned at all.

The next experiment was made with gas that had passed through the cleaning plant for gas engines, which includes a spray tower, baffle tower, and Theisen washer. Even if the gas was desirable for boilers or hot blast stoves, this method of cleaning same would be prohibitive from the standpoint of cost. A disadvantage of this method, disregarding the cost, is the fact that the sensible heat of the gas is reduced to such a point that the usual size combustion chamber is not long enough to obtain complete combustion. The gases, therefore, enter the boiler proper partly unburnt, coming in contact with the heating surface of the boiler, which is at the temperature of the steam, causing the gases to give up the heat of combustion, thereby reducing the temperature of the unburnt gases below the ignition temperature, with the consequent incomplete combustion of the gases, resulting in a loss that might otherwise be prevented.

Generated on 2024-09-08 14:02 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

The moisture content of the gas was reduced to about 30 per cent of the original with this method of washing. To accomplish this, however, it was necessary to reduce the temperature of the gas to the temperature of the water used for cleaning. If the temperature and the moisture content of the gas entering the boiler were the same as in the waste gases leaving the boiler, it would not be possible to sustain the loss of a single Btu. With any normal operating condition of the blast furnace, there is a decided advantage in favor of retaining the temperature of the gas as coming from the furnace, even in view of the fact that the gas contains the additional amount of moisture.



Kling-Weidlein dry gas cleaner being erected at No. 1 furnace, Ohio Works, Carnegie Steel Company.

An experiment was then made with hot gas taken directly from the dust catcher, and much better results and efficiencies were obtained than with either of the former experiments, although large quantities of dust had to be contended with, and the dust had to be blown off the boiler tubes frequently.

In view of the results obtained from the above experiments, and the advantages so prominent in favor of hot gas, various means were employed to develop a cleaning method in which the dust could be removed from the gas without reducing the temperature.

After careful study and experimenting, a very novel means of removing the dust from the gas was developed, and an experimental cleaner was built, designed to handle 6,000 cu. ft. gas per minute at 62 degrees F. This plant was in operation, off and on, for about six months, being taken off and changed as various improvements were developed. Results were obtained that were truly remarkable in view of the difficult problem of removing the very fine or impalpable powder from the gases—results that equal and surpass cleaning efficiencies of the best types of wet washers.

The gas passing through this experimental cleaner was consumed under a 400 hp Stirling boiler, and after a month's operation, without blowing the tubes, there was less than 50 degrees F. increase in temperature of waste gases on account of the dust accumulation. What little dust came through the cleaner was of such nature that a large portion of it was carried through the boiler and out with the waste gases. However, the portion deposited on the tubes was easily removed by blowing it with a hand steam lance. The dust carried by gas which has been wet washed, bakes onto the tubes and is hard to remove. During a slip of the furnace, the dry cleaned gas would burn as usual, while the flame would extinguish in an adjoining boiler, using wet washed gas, due to excessive dust. The boiler was completely equipped with recording instruments and it was shown that it would not be necessary to blow the tubes oftener than once in two to three weeks to maintain almost uniform boiler efficiency.

This experimental cleaner was inspected by various individuals and committees, and was pronounced a remarkable development, and one which would revolutionize cleaning methods for blast furnace gases.

Due to the very satisfactory results obtained from the above experiment, the United States Steel Corporation authorized the installation of a cleaner large enough to clean all of the gas from one blast furnace. This cleaner was installed at No. 1 Blast Furnace of the Ohio Works, Carnegie Steel Company, Youngstown, Ohio, and was built and ready for operation without interfering with the operation of the blast furnace, the latter being banked only long enough to make a connection to the existing dust catcher. This furnace has a capacity of 550 tons of iron per day, and produces 80,000,000 cu. ft. of gas which passes through the cleaner daily.

The cleaner proper was constructed of reinforced slag concrete due to the scarcity of steel plates during the war. The accompanying photograph shows the cleaner in course of construction. The idea of using concrete for this purpose is quite novel in itself. This structure was built to withstand an explosion pressure of 15 pounds per sq. in., and it is well equipped with explosion valves of special design, which are set to open at 1 pound pressure per square inch. The walls, being 15 inches thick, act as a very good insulator to retain the temperature of the gas. The concrete has shown no deterioration, and has withstood all conditions to which it will be subjected, and no trouble is anticipated.

With requirements favoring steel plate in preference to

Generated on 2024-09-08 14:00 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

concrete, the inventors have designed a very adaptable construction which should appeal to the most skeptical.

A course of Sil-o-cel insulating brick was used in addition to the regular lining of firebrick in the gas piping, as the idea of retaining the sensible heat in the gases was foremost in the minds of the inventors.

The operation of the cleaner is entirely automatic and does not require constant attendance. One of the men from the regular force maintained in blast furnace operation inspects and lubricates the machinery once or twice a day.

That the project was well engineered is shown by the fact that the cleaner, when put in operation about two months ago, without any preliminary trials, worked satisfactorily, which is remarkable when considered that it is the first large installation of its kind. This cleaner has been in continuous operation since that time, which demonstrates that it is thoroughly reliable.

The power required to operate this cleaner 25 per cent of the time is 4.25 hp, and 75 per cent of the time 2 hp, making an average power requirement of 2.56 hp as compared with 80 hp to 100 hp for wet washer.

The dust is accumulated in hoppers of sufficient capacity to hold two or three day's accumulation. It is then dumped into standard hopper cars, the operation requiring only about one-half hour to remove the dust from the cleaner.

Since this cleaner has been in operation, an additional 25 per cent of dust in the gas leaving the dust catcher has been reclaimed. Heretofore, this was carried away in the water that was used for washing the gas, although it was supposed that very complete settling of the dust was being obtained in large settling basins. The average amount of dust deposited in this cleaner since starting operations is 63,500 pounds per 24 hours, although the gas has previously passed through a dust catcher 30′ 0″ in diameter. This represents 48.6 per cent of the total dust leaving the furnace by way of the downcomers.

The cleaner is maintaining a cleaning efficiency of 90 per cent to 97 per cent, the dust content in clean gas being .10 to .30 grains per cu. ft. at 62 degrees F.

The range of temperatures of the gases which have passed through this cleaner is 150 degrees F to 800 degrees F., and the average loss in temperature due to radiation is 25 degrees F. to 35 degrees F. with atmospheric temperature ranging down to 10 degrees F. There have been instances where the temperature of the outgoing gas has been 150 degrees F. higher than the incoming gas. This is due to a condition where the incoming gas was very low in temperature, the massive concrete walls having stored up the heat from gas of high temperature which previously passed through the cleaner, and giving it up to the gases of low temperature, the structure acting as a heat equalizer.

The resistance to flow or back pressure on the furnace is only 2 inch to 3 inch water gauge. This includes all piping to and from the cleaner, and the cleaner itself. This is considerably lower than the resistance through any type of wet washer.

The cleaner is connected to a blast furnace that has been in operation for four years on the present lining, and it has been subjected to all of the conditions which are characteristic of an old furnace.

The cost of an installation for cleaning gas by this method compares very favorably with the cost of a complete wet washing outfit; and considerably less ground space is required, due to the absence of settling basins.

The beneficial results from this method of cleaning are so pronounced that great interest has been shown in the form of inquiries and investigations, and they demonstrate the opportunities which are paramount in the field of dry cleaning furnace gases.

During the comparatively short time that this method has been demonstrated, several additional installations are being contemplated at various places, including another cleaner to be built at the Ohio Works.

Adopting the method of dry cleaning gas permits other changes in practice that appear on the whole to be very advantageous. By having hot gases enter the hot blast stoves, it is possible to obtain higher flame temperature in the stoves, which will result in a saving of coke, since a higher hot blast temperature will be available. It will be possible to operate the furnace with fewer stoves by equipping the stoves with smaller checkers, thereby obtaining better operating efficiency. An installation for cleaning all of the gas from a furnace would cost about the same as a hot blast stove.

A summary of the advantages to be obtained by the dry cleaning over wet washing of furnace gases is as follows:

Sensible heat of the gas is retained.

When burned under boilers, the gas generates more steam.

When burned in hot blast stoves, produces higher blast temperature.

No water is required for cleaning the gas.

No settling basins are required.

Less ground space required, due to absence of settling basins.

No pollution of streams.

Less labor cost in handling the dust.

Less than one-tenth the power required to operate.

Less back pressure on the furnace.

Cleaning efficiency as good as the best types of wet washers.

No sludge dripping from gas mains and burners.

Generated on 2024-09-08 14:05 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

Water Cooled Equipment for Open Hearths

Description of Equipment Preventing Distortion of Frame Work and Maintaining Economy of Refractories — Illustrations Point Out the Adaptability of Water Cooled Equipment.

By WILLIAM C. COFFIN.
Vice President Blaw Knox Company.

The refractory linings of open hearth steel furnaces above the bath line are subject to severe wear not only from the heat caused by the combustion of the fuel and the reactions of the bath, but also from the melting action of the gases when not controlled and directed, and from the scouring of the oxides, etc., with which the products of combustion are charged.

The framework that encases or binds the furnace is made up primarily of an iron or steel pan in which the furnace proper is built, side and end buckstays, and tie-rods. The expansion and contraction are so great and variable that the bindings may be subjected to severe stresses unless the tie-rods are carefully adjusted in heating up the furnace, but they are most affected by direct heat and usually become deformed from that cause when the lining is worn thin and, sometimes when sections of the lining fall in and expose some of the framework.

A deformed framework displaces the skewback of the roof arch and tends to distort or crush the roof. Bent buckstays deform the front wall, causing the door frames to stand away from the lining so that the gases burn between the lining and the frames destroying both of them. Frequently the frames are attached to the buckstays; then when the latter bend the frames usually break.

Preventing the distortion of the framework and maintaining the economy of the refractories are real factors in the cost of steel making. Not only does the cost of general repairs and reconstruction add directly to the cost of steel produced, but the time lost in making repairs cuts down the steel production and increases the overhead expense of both the furnace shop and its allied foundry or mills.

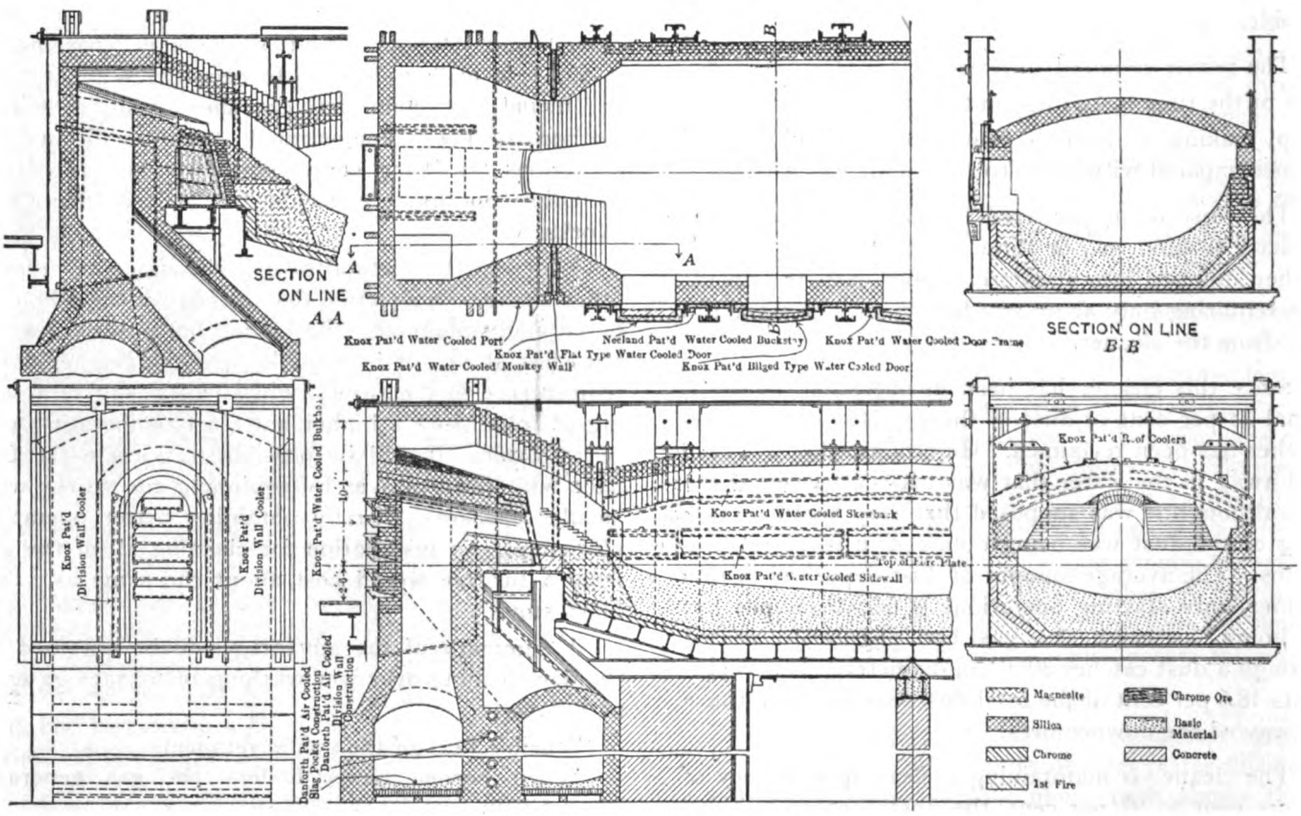


Fig. 1—Open hearth steel furnace equipped with water cooled devices.

Abstract of paper read before A. I. M. E. February, 1919, New York meeting.

Generated on 2024-09-08 14:02 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

Many years ago water-cooled equipment applied to iron blast furnaces made it possible to increase greatly not only the size and production of the furnaces but also the life of the lining. It also cut down the loss from frequent repairs. The open hearth furnace is a much later invention, especially as a commercial factor; for though it dates from the Fred Siemens patent of 1856, much more progress was made in the Bessemer process until the latter eighties and most of the

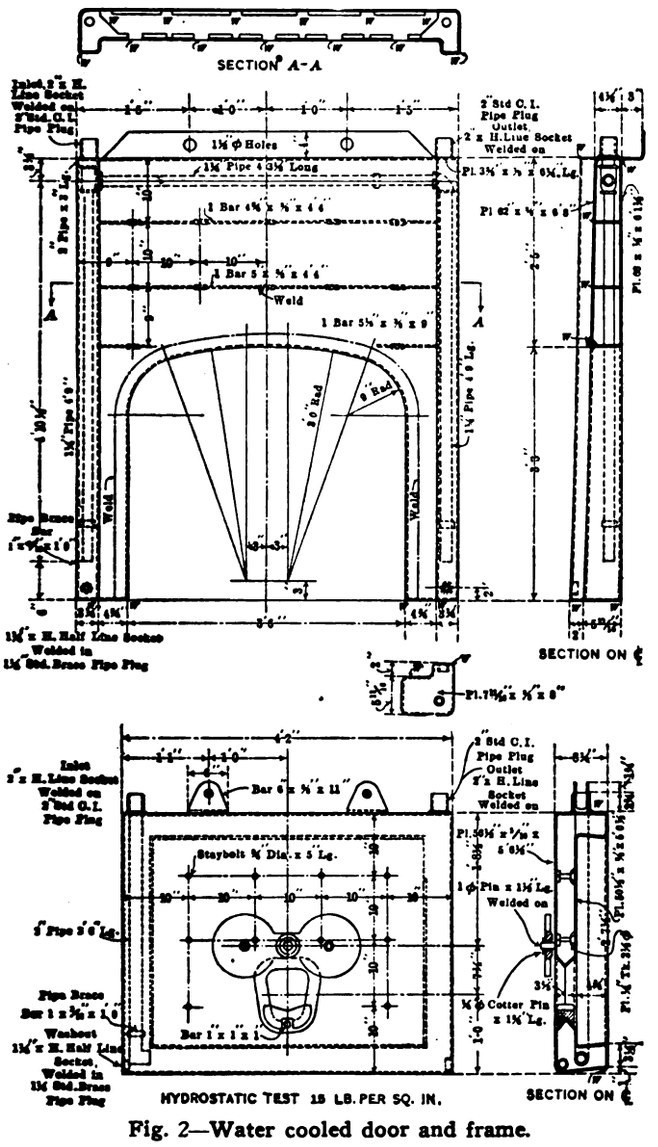


Fig. 2—Water cooled door and frame.

development of open hearth furnaces, especially in large furnaces and aiming for big production, dates from the memory of men still "in the game" and does not go back more than 25 years. Most of the advancement in water-cooled equipment is of even later date and it is within the last 10 years that it has become quite general practice to apply some form of water cooled device to protect and increase the life of the ports and bulkheads, which suffer most from wear and tear and which require the most attention and expense to maintain.

Cast iron and cast steel doors and frames were water cooled by means of hollow castings in which water circulated and by casting pipe coils in them.

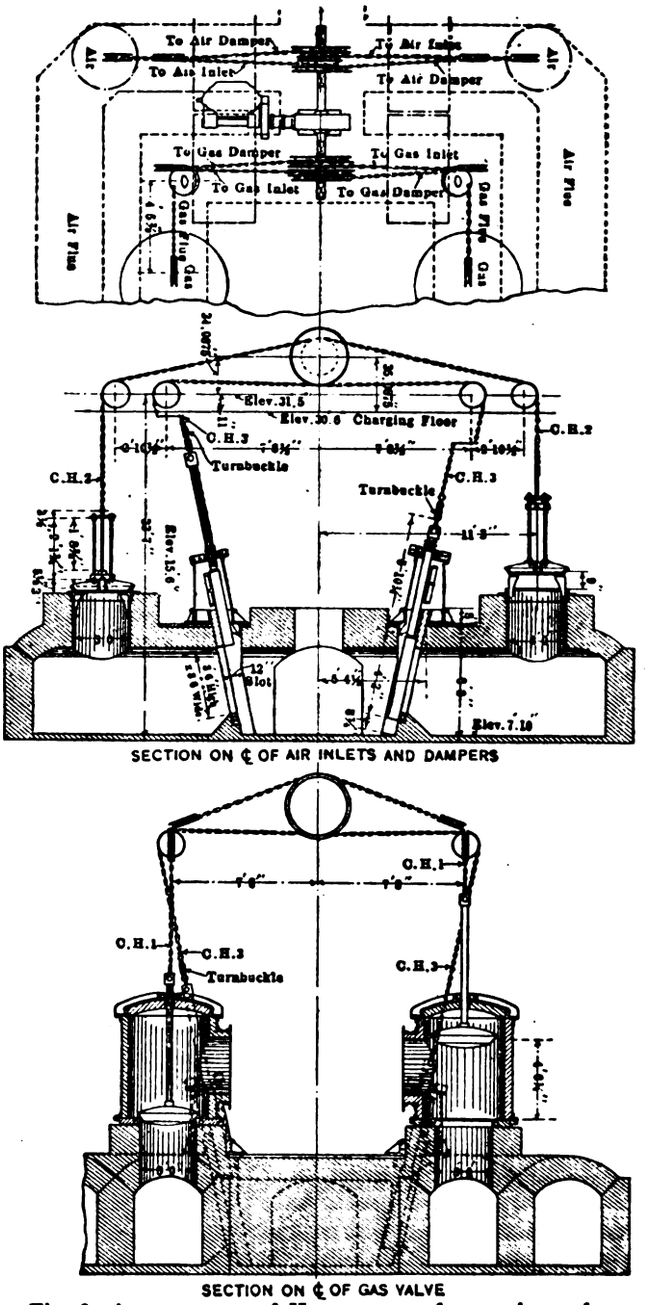


Fig. 3—Arrangement of Knox patented reversing valve.

These are still used at some plants, but a casting is not a good enough conductor for the water to sufficiently cool the outside surface to protect it, so it is liable to burn out and also to crack and warp. As the heat is very much greater in the ports, other means are necessary to protect them. Quite a few copper bronze water cooled castings have been used with some success, but they can be successfully made only in moderate sized castings and are easily pitted and injured by slag.

Generated on 2024-09-08 14:01 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

Adaptability of Steel Plates for Water Cooled Equipment.

Steel plates about ⅜ in. (9.5 mm.) thick can be readily formed into almost any shape desired for water-cooled equipment for doors and frames, buckstays, skewbacks, port coolers, division wall coolers, bulkhead coolers, etc. If properly designed and flanged to keep the joints from undue stresses, the joints can be welded. Riveting is undesirable both on account of the liability of leaking and because the doubling up of thickness at the joints makes proper cooling impracticable. Steel plates have all the qualities of strength, ductility, and conductivity that make them especially applicable to this use, and they can stand contact with furnace slags and oxides without injury. They are also more free from defects and can be more readily and completely inspected than other materials. The conductivity of steel plates keeps the outside surfaces at nearly the temperature of the water in the device so that if it is in contact with the refractories it has much the same action as coolers in blast furnaces.

In contact with brickwork, which is a very poor heat conductor, the cooling effect will penetrate, at most, about 6 in. (152 mm.) and usually be effective in keeping the brick from softening with the heat for only 4 in. The result is that this type of equipment, if covered a few inches deep, does not have any cooling action on the interior of the furnace and, therefore, does not add to the fuel cost nor cause the furnace to be sluggish. This is at once noticeable with the 4½-in. brick lining on steel plate furnace doors which forms a slag coating on the exposed face after thinning down 1 in. or less and will frequently last a full campaign of the furnace run unless jarred out.

About the year 1900, L. L. Knox, of Pittsburgh, Pa., who was engaged in the construction of open-hearth furnaces, began the study of water cooled equipment and has since devoted most of his time to the development of these devices. With the exception of a few riveted steel-plate doors and frames, he at first designed and installed copper coolers. In 1909, he turned his attention entirely to welded steel plate devices, which have come into such general use that the latest developments should prove of interest to all engineers in any way associated with the open hearth steel industry, or who wish to keep up with the growth of its equipment. Many of these devices have a much wider application and are already installed on heating furnaces, soaking pits, copper furnaces, and glass-melting furnaces, and engineers familiar with these various types of furnaces can see where they can be applied to increase the life and reduce the maintenance cost. These devices have been patented by Mr. Knox, with the exception of the Neeland buckstay, which was patented by M. A. Neeland, formerly chief engineer of the United States Steel Corporation. They are manufactured and sold outright without any royalties or limitations as to their use.

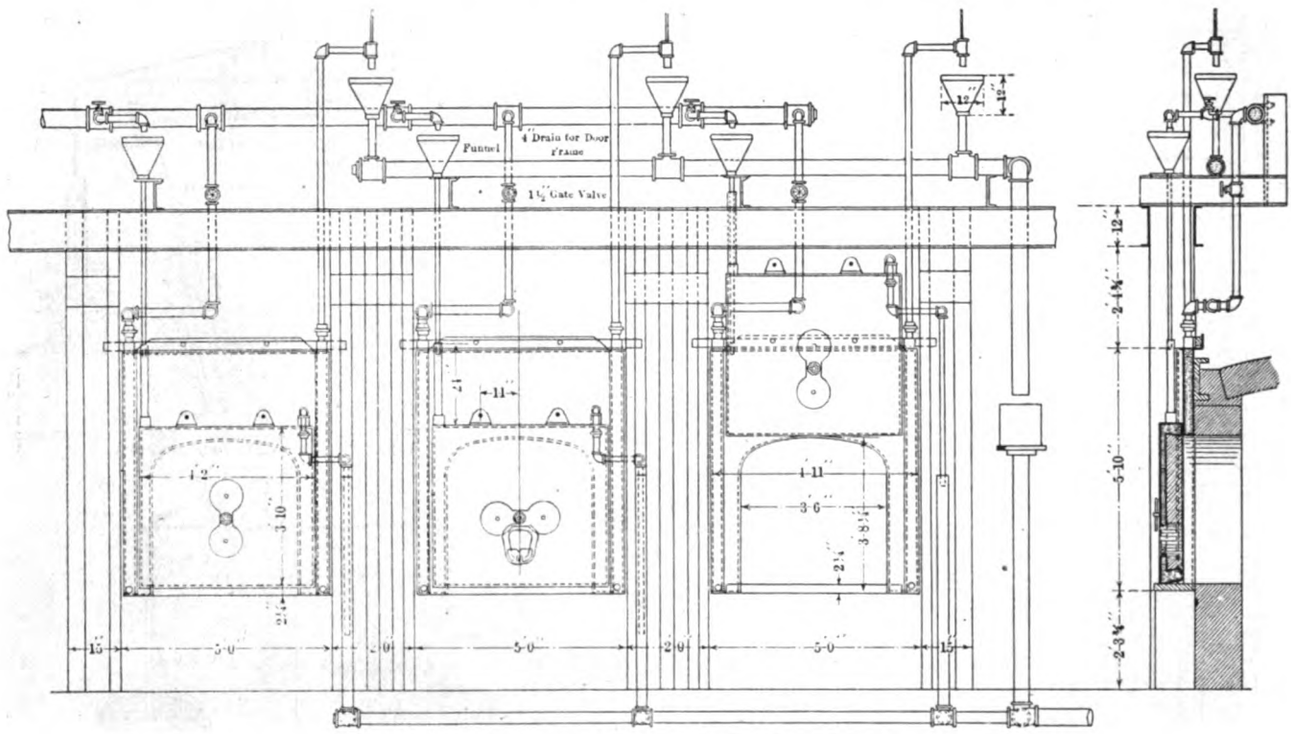


Fig. 4—Direct feed water connections for doors and frames.

Illustrations of Water Cooled Equipment.

Fig. 1 illustrates an open hearth steel furnace equipped with water cooled devices at all essential

Generated on 2024-09-08 14:05 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

points, each of which will be referred to separately.

Fig. 2 shows a door and frame, all welded joints of which are kept away from both the back of the frame and the door opening. The back plate is flanged through the door opening and turned back about 2½ in. on to the front plate, which not only takes the welded joint away from the extreme heat but strengthens the door arch, which is subject to stresses from expansion and contraction. The stay-bars and stay-bolts do not penetrate the back plates of either doors or frames, but are welded on to the inside surface before the outside plate is welded; this avoids any possible leaks against the brickwork. Many of these doors and frames have been in continuous use for three or four years, whereas cast ones seldom last more than a few months. The jambs and arches also last much longer when in contact with these frames and the furnace operators can give the process of melting more efficient attention on acount of the cool front.

Fig. 4 shows the doors and frames connected with a direct feed-water line. The raising and lowering of the door is taken care of by a telescopic inlet pipe.

Fig. 5 shows a circulation system applied to a tilting furnace, taking care also of chills at the connection between the furnace and the port ends, and of port coolers.

Fig. 6 shows the port end with the location of the port cooler. This cooler is carried across the port end the full width and both ends of the cooler are exposed; this gives access to the water connections and allows the cooler to be put in place and removed by the charging machine. The charging machine, of course, brings it out only far enough for the overhead traveling crane to get hold of it; when there is no traveling crane, the cooler is placed half way into the furnace with block and tackle and the charging machine pushes it into final position. The port cooler is located at the point where the mixture of the gas and air creates the best combustion, the gas being directed toward the bath. With a dry port, the brickwork is built much nearer the bath than it should be but this is necessary to allow for its wearing away, and it is not rebuilt until it is worn back beyond the point of good combustion. This construction not only makes a waste of fuel, but the lack of control of the direction of the gas causes it to burn both the roof and the side walls.

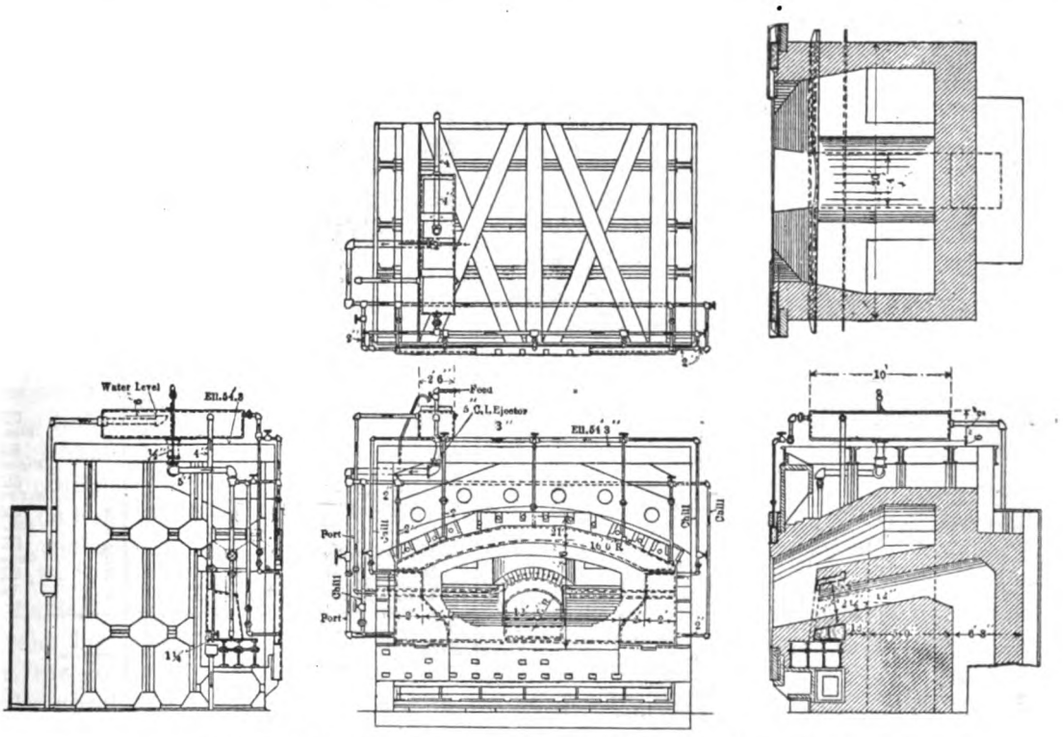


Fig. 5—Circulation, water system applied to lilting furnace.

This burning is prevented by the port cooler, as the gas port is held to its proper position and also to its original size, with the result that the furnace works sharply and continuously until the checkers become so clogged that the furnace must be shut down to clean them and rebuild at least the top courses.

Fig. 3 shows a general arrangement of the Knox gas and air-reversing valves. The Knox valve goes back to the first principles, as it is based on a simple vertical damper operating directly in the flues. Other types of valves operate above the flues and require uptakes and downtakes, which reduce the draft usually to 40 or 50 per cent of the stack draft. They have no means for regulating the draft except by a stack damper, which does not make any individual control of the furnace ports nor a separate control of the gas

Generated on 2024-09-08 14:06 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

and air checkers. Each Knox valve is a regulating damper; and when most of the products of combustion go through the gas checkers, leaving the air checkers cold, the gas valve can be opened very slightly, or not at all, causing the draft to come through the air checker and heating it. The valves are slightly inclined so as to insure close contact and tightness between the damper and the seat. There was some question as to the effect of tar on the surface of the seat, but it has been found that the tar is only a lubricant, and insures tightness. The valve damper is constructed with a thin steel frame so that the contact between the damper and the seat is narrow, but both the damper and the seat are machined so as to insure flat surfaces. The construction of the damper, with corrugation on the plates, takes care of a slight difference in expansion and contraction between the plates and the outside frame.

These valves are now installed in about 75 furnaces and are a great aid in having the furnaces work sharply, on account of the assured draft and the individual regulation of each chamber. The operating rigging, which is in most cases worked by an electric motor, is so designed that the gas-reversing valves work in a series ahead of the air-reversing valves so that there is no mixture of gas and air, which might cause an explosion, especially when waste-heat boilers are used.

Fig. 1 shows roof-arch coolers, back-wall coolers, and water-cooled skewbacks. These are not in very general use, but have their advantages wherever the operators find that their furnaces are cutting out at these different points. One furnace plant has water-cooled skewbacks on 16 furnaces. Although there is a general tendency among American plants to exchange information of value and operators from one plant are usually welcomed at other plants, direct reference to the installation of special apparatus should not be published. For this reason the writer has refrained from mentioning where the several water-cooling devices described are in use. Engineers interested in the general problem will find water-cooled devices in almost any plant they may visit and will also learn that the problems to be solved in one plant vary considerably from those in others. The only way to secure the best results is to consider each furnace shop as a different proposition, so that the cooling devices may not only be installed where they are most needed, but that the details are made to especially suit their requirements.

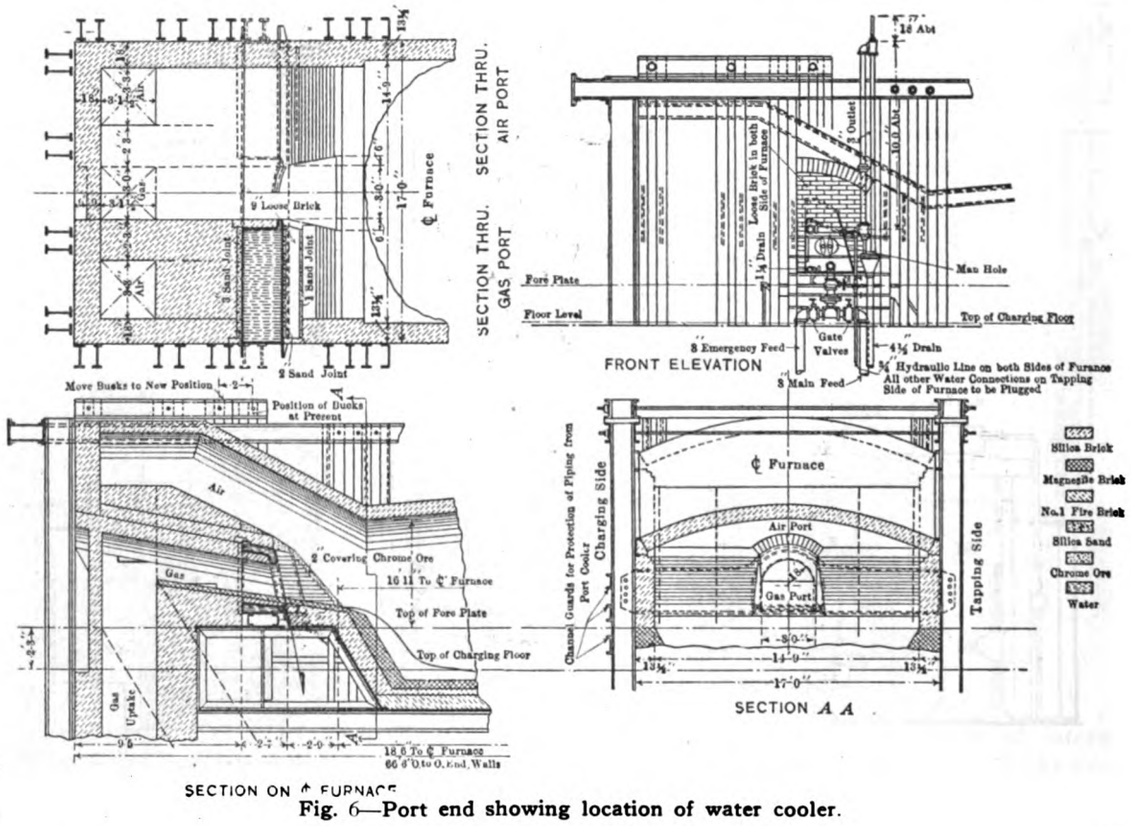


Fig. 6—Port end showing location of water cooler.

Amount of Circulation Water Necessary.

The amount of water necessary for circulation will vary not only with the size of the different devices but with the condition of the furnace. It is dependent also on the quality of the water. When the water contains lime or other solids that precipitate when the water is heated, it should at once be determined in

(Continued on page 197.)

Generated on 2024-09-08 14:05 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

New Blast Furnace Gas Cleaning Outfit

Ruddiman Scrubber and Combined Cooler and Dryer—Cleaning Apparatus Combines Principle of Contact Type of Cleaner With That of Scrubber Type—Economical Use of Water Important.

The following article describes and illustrates a blast furnace gas cleaning outfit. The outfit consists of a scrubber and a combined cooler and dryer as shown in the illustrations.

The scrubber comprises either a square or rectangular tank having a hopper bottom for holding the waste water and a semi-circular cover which incloses a gas chamber into which the gas inlet pipe enters at one end and the gas outlet pipe at the opposite end. Passing longitudinally through the tank is a shaft supported and driven from without the tank by any suitable means. Stuffing boxes are provided to prevent the escape of gas at the points at which the shaft pierces the wall of the tank. Upon the rectangular midportion of the shaft within the tank is arranged a series of circular perforated baffle plates. Nozzles are fitted into the holes of each baffle plate, except the last of the series, the sum of the area of the nozzles in each baffle being slightly in excess of twice the area of the gas inlet pipe.

The baffle plates are suitably spaced apart along the shaft and secured thereto by flanges bolted to each baffle and having hubs, with set screws or keys, which serve to space the baffles apart. The baffles, which are parallel to each other, are supported in a vertical position, by ferrules on bolts which pass through the series of baffles at a convenient radial distance from the shaft and bind the baffles together when the nuts are set up. The baffles have their nozzles so arranged that those of one baffle discharge against the blank interspaces on the following baffle so that the gas issuing from the nozzles in fairly close proximity to the adjacent baffles is brought into intimate contact with the blank spaces of the latter.

Spray pipes are arranged between the baffles and at the inlet and outlet ends of the gas chamber. The latter are designed to throw a spray upon the wall of the gas chamber to clean the latter, while the pipes between the baffles are so arranged that their jets are discharged against the adjacent faces of juxtaposed baffles and into the nozzles thereof, so that both the surfaces of the baffles and the interior of the nozzles are cleaned.

The principle of the contact type of cleaner with that of the scrubber type is combined in this apparatus. It is self-cleaning and economical in the use of water.

At the ends of the tank internal overflow troughs are provided, which maintain the normal water level of the water in the tank slightly below the center line of the shaft. A water seal is provided by waste pipes connected with the overflow troughs and maintains the water level in the latter lower than that of the water in the tank.

The cooler and dryer consists of two truncated cones, united at their bases to form a single section, or chamber of a vessel comprising several sections, united to form a passage for the gas. The end sections connect with the inlet and outlet pipes.

A shaft extends centrally through the vessel, and is supported by graphite or oil lubricated bearings mounted on hangers inside the sections, and brackets attached to the elbows of the end sections, to which are attached stuffing boxes to prevent the escape of gas. The shaft is protected from abrasion at the inlet, by a sleeve attached to the stuffing box casting. The inside bearings are suitably shielded from water and dirt (details not shown).

Mounted in pairs along the shaft at the entrance to each section, except the outlet section, are circular perforated baffle plates. Nozzles are fitted into the holes of the first plate of each pair. The sum of the area of the nozzles and holes in each plate is slightly in excess of the area of the gas inlet pipe.

The baffles have their nozzles so arranged that they discharge against the blank interspaces on the opposite baffle, so that the gas issuing from the nozzles is brought into intimate contact with the blank spaces before passing the holes, and into the expansion area of the section. The sections with their respective baffle plates are not limited to the number shown, but may be increased or diminished to meet any condition.

In the last or outlet section, is arranged a series of baffle plates. Each is fitted with nozzles except the last of the series, which has holes only. These baffles slightly increase in diameter toward the outlet, so that each will maintain the same distance from the wall of the cone surrounding them, thereby, practically confining the passage of the gas to the nozzles. Each section is provided with a manhole repair door for the passage of the baffles, which are made in two parts.

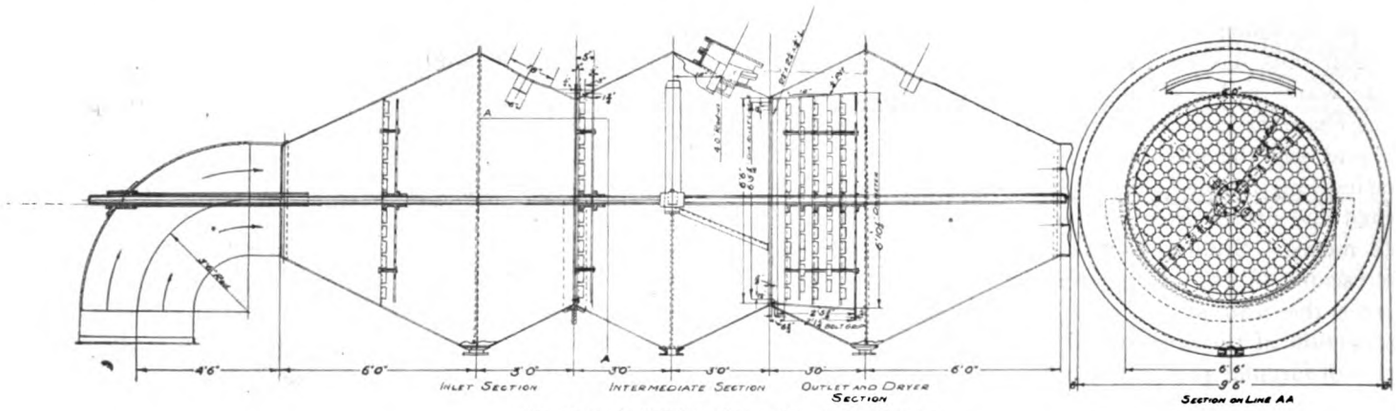
A system of spray pipes and nozzles (not shown) furnish an abundant supply of water. The drainage system conducts the dirt and water to a settling tank, whence a part is conducted to the spray system of the scrubber, Fig. 2, to be used again in the preliminary cleaning of the gas. The overflow from the tank, and the dirt, which is periodically flushed into the overflow pipe, is carried to the tank portion of the scrubber. The cooling water is thus made to scrub the gas,

Generated on 2024-09-08 14:12 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

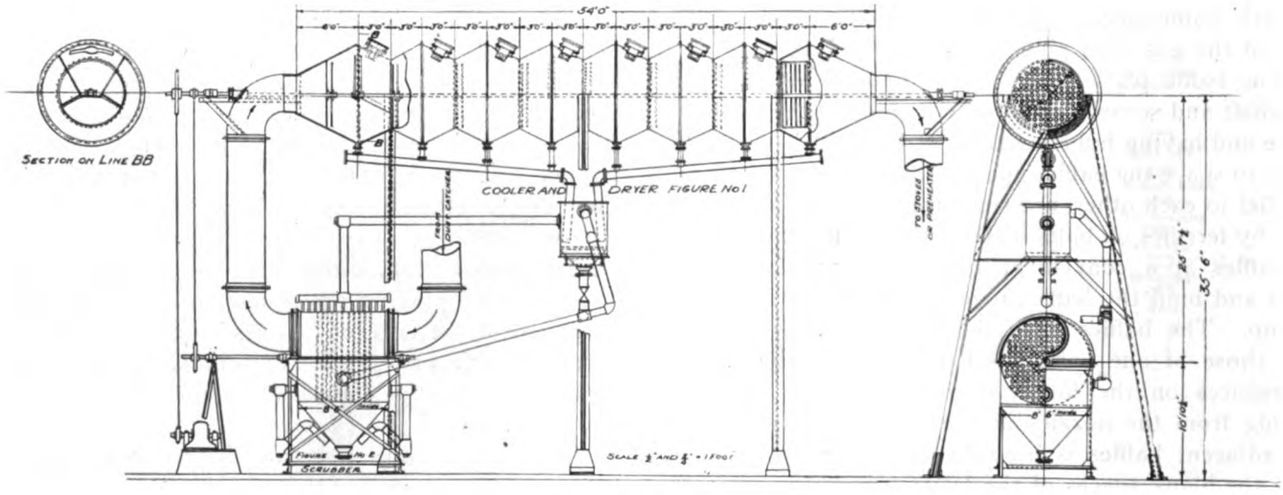
while all the water and dirt of cooler and scrubber is centralized for convenient disposal.

In operation the gas from the dust catcher enters the scrubber and is broken up into a large number of small jets by its passage through the nozzles; a portion of the dust is deposited on the wet surface of the first baffle. Passing through the nozzles of the first baffle the gas jets impinge on the wet blank surfaces of the second baffle, which surfaces are directly opposite the nozzles. The velocity of the gas passing through the nozzles is practically undiminished, since the sum of the areas of the nozzles above the water level is but slightly greater than the area of the inlet pipe. Dust is deposited on each baffle in succession in this way, the process being repeated as many times as desired and being determined by the number of baffle plates used. Spray pipes between the baffles furnish cooling water in finely divided form, thereby further increasing the efficiency of the cleaner by scrubbing and cooling the gases as they pass between the baffles.

The dust deposited upon the baffles is constantly removed by their rotary passage through the water in the tank, so that they constantly present a freshly washed surface for the gas to impinge against and the baffles are kept cool and wet during their transit through the gas chamber (at 20 rpm no part of the baffle is in contact with the gas longer than 1½ sec.). The nozzles have a bucket-like effect in lifting the water into the gas chamber, thus aiding in cleaning and cooling the gas as well as the surfaces of the baffle plates. The water in the tank is constantly agitated by passage through the baffles and this prevents the accumulation of floating dirt at the water level. The scum is carried off with the overflow by drain pipes connected with troughs arranged at the ends and inside the tank at the water level. The water is admited to the tank below the water level and to the gas chamber through pipes connected with a settling tank arranged above the scrubber to receive the waste water from the cooler and dryer. The supply is thus made to do double duty.



Sectional detail of cooler and dryer.



General arrangement of scrubber, cooler and dryer.

From the scrubber the gas passes to the cooler and dryer and, as in the scrubber, is broken up into small jets to impinge, at high speed, onto the wet surface of the opposite baffle, depositing a portion of its dirt. On passing through the holes of the second baffle of each pair the gas expands and moves slowly

Generated on 2024-09-08 14:05 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

through the enlarged area of the sections meeting en route a copious supply of cooling water in the form of a fine spray.

The rapidly revolving baffles (about 100 rpm) impart a whirling motion to the gas which prevents channeling through the cold showers. The centrifugal action thus set up causes the dirt and water, caught by the baffles, to be thrown to the walls of the sections whence a speedy run to the drain is induced by the angle of the sides.

The alternate increase and decrease of the speed of the gas through the several sections causes a succession of dirt deposits and fresh supplies of cooling water which mingles freely with the gas and prevents accumulaltion of dirt on the baffles and walls.

On passing through the last pair of baffles, the gas enters a dry section before reaching the series of baffles in the outlet section. These are designed to remove the entrained water by the combined effect of repeated impingement at high speed, the quick and continuous removal of the deposited water by centrifugal action and prompt drainage. Provision is made is made for flushing all parts in the drying zone when or if necessary. An electric motor is shown for driving the apparatus but any convenient power may be employed.

A platform and ladder will be provided for access to water system and manholes. The cooler and dryer may be connected up with any type of gas cleaner or scrubber.

Mr. John Ruddiman, 229 First street, New York, is the patentee of the above described apparatus. More detailed information can be secured from him.

Metallurgical Work of Bureau of Standards

A Review of the Research Work Concerning Welding, Tin Conservation, Bearing Metals, Protective Metallic Coatings, Sand Investigations, Etc., Conducted by the Bureau of Standards.

By G. K. BURGESS.

PART II.

This is the conclusion of the article which appeared under the same caption in the March issue of THE BLAST FURNACE AND STEEL PLANT.

All the tin used in the United States is imported and there appearing a threatened shortage, the bureau has assisted the War Industries Board, after conferences and extended correspondence with manufacturers and consumers of articles containing tin, in making a program of limitation in its use and development of substitutes. The experimental work has followed the lines of finding suitable solders, reduction of tin in bearing metals, modifying bronzes, and recovering tin scrap. Suggestions to the government departments concerning modification of specifications to conserve tin have also been made.

Bearing Metals.

Service tests of different compositions of bearing metals have been made with a view of determining the adaptability of certain lead base babbits hardened with alkali or alkali-earth metals. It was found that in some respects they were superior to genuine babbitt and their use is being recommended in certain cases.

The information assembled on this topic and the few tests which have been made on special bearing metals indicate a need for a systematization of our ideas concerning bearing metals in general, the advantages and disadvantages of different types, as well as some more extended study of the behavior of different compositions of both babbitts and bronzes in service. A circular is in preparation dealing with bearing metals, and upon its completion a program of bearing metal investigation will be mapped out.

Metals at High Temperatures.

It is hoped to be able to carry out experiments on interrelations of stresses and strains and the phenomena of annealing and hardening including effects of sizes and geometrical shapes as well as more thoroughly quantitative studies of mass as related to heating and cooling rates.

Another problem to be taken up is that of the tensile properties of metals at high temperatures.

The constantly increasing use of metals and alloys at elevated temperatures, such as in turbine blades, pistons, etc., demands a thorough investigation into the physical properties at higher temperatures. Particularly, a knowledge of the stresses which will be borne by metals and alloys at these temperatures without yielding is desired on every hand.

Apparatus has been designed for this work, which it is hoped will be continued in the near future.

In a study of the heat treatment of various high alloy steels, it is hoped to determine more completely the relations among the alloys in their effect on iron alone, and to proceed from that to the steels.

Generated on 2024-09-08 14:11 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

In the quenching of steels, quenching data in the literature refer to "quenching in oil," "in hot water," etc. It is proposed to put all such treatment in a standardized basis, e.g. "a cooling rate of 93 degrees C. per second through the transformation range," etc., such data being obtained by use of the Einthoven galvanometer. Studies of grain size, hardness, and difference between inside and outside of specimen will be included.

Protective Metallic Coatings.

In a study of the effects of rust-proofing on the brittleness of wires, started at the request of the International Aircraft Standards Board, a preliminary examination was carried out with tensile tests of wires, taking the elongation in tensile test as a measure of the brittleness. While some conclusions as to effects of cleaning, plating, etc., could be drawn, the results were not sufficiently definite and a new form of test piece was required. It was decided to adopt the impact test, and an impact machine of the Izod type was designed and built. The experimental program covers the various compositions and sizes of wires in common use, and the investigation is to be extended to include especially the brittleness of small springs. In coöperation with the American Society for Testing Materials, a joint program is being carried out on zinc coatings, their properties, methods of test, structure, and effects of various coatings on the base metal.

Studies have also been made of the microstructure of wrought iron, gun erosion, iron carbon transformations, copper plugs for testing cartridge powders, metals for instrument parts, and in the foundry the investigation of casting methods and types of test bars as carried out by five foundries in an identical program and using metal cast in one heat has been completed and the physical properties of the brass determined. The metals used were government bronze (88 Cu, 10 Sn, 2 Zn), and a modification containing 88 Cu, 8 Sn, 4 Zn. The results are ready for publication.

The effect on the physical properties of small additions of various metals to government bronze is being studied systematically, and similarly for addition to aluminum. Special alloys suitable for castings are also made and examined as requested.

The type of test bar for different non-ferrous alloys is being investigated.

The foundry serves the bureau and the research laboratories of other departments and Washington institutions in preparing a great variety of kinds and types of metal and alloy castings. The new quarters have greatly extended its possibilities for service and research.

Sand Investigations.

This question has been taken up anew with regard to (1) reclaiming "burnt" steel foundry sand, (2) the production of artificial sands and establishment of standards, and (3) development of tests of sand qualities. The first has already given promise of demonstrating to some foundries the reclaiming of 90 per cent of the sand at a reasonable cost. The Washington Navy Yard foundry and others are coöperating in this work.

In preparative metallurgy and metallurgical chemistry, the electrolytic carbon method has been developed and is being published. By this method an accurate determination of carbon in steel can now be made in 4½ minutes. There has been studied the rapid determination of carbon in steel by the barium carbonate titration method, in which again the means for increasing by 50 per cent the output of work by using this method has been obtained. A very considerable amount of research work is being done on the very important subject of gases in steel, the methods of analysis, and the actual quantities in steels of different types of manufacture. This field of work promises to be one of the most fruitful and instructive in metallurgy, and will probably form the basis for a very considerable revision of our ideas regarding the relations of gases to metals. The work of standardizing the gas analysis methods and the determination of their reliability has proved of great difficulty and surprising uncertainties and irregularities have been found in the methods ordinarily accepted as classic. Several papers are about ready for publication embodying the results of these investigations. These will include, for example, the determination of nitrogen, carbon monoxide, hydrogen, etc., in steel, a critical study of the Goutal method for determining gases in steel and the Ledebur method for determining oxygen in steel, the determination of gases in steels by the Goeren's method, and the oxygen content of steel deoxidized in various ways, equilibrium between iron oxide, carbon and hydrogen.

Another field of preparative metallurgical research of fundamental importance is the making from strictly pure materials a series of iron alloys free from the ordinary impurities found in steel, with the idea of furnishing material on which the physical properties of the alloys in exactly desired combination can be determined, as, for example, an iron carbon series absolutely free from phosphorus, sulphur and manganese, and similarly a series of iron manganese and iron manganese carbon, and then modifying these by successive additions of the ordinary impurities found in steel. It is believed that the systematic prosecution of this type of research will put the metallurgical fraternity in a position to have its base standards to work from.

Generated on 2024-09-08 14:03 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

An interesting problem that has come to us from the Emergency Fleet Corporation was the study of possible methods of coating concrete with metals which will be unattacked by gasoline or salt water and stand strain due to the working of ship.

A very great deal of special investigation of metals, particularly steels, has been done for the Ordnance departments of the Army and Navy and for the departments of Aircraft Production, Engineering, etc. Some of the problems studied have been, characteristics of centrifugally cast steel, several cartridge case problems, armor plate problems, flaky steel, metals for aircraft instruments, etc. Many new alloys and metals have been submitted to the bureau for examination by individuals, as well as by the military departments, to determine their fitness for the uses for which their sponsor projected them. This covers a host of materials.

A great deal of the time of the metallurgical staff has been spent in consultation with the various boards and committees of the Army, Navy, War Industries Board, National Research Council, etc., on metal specifications and problems, and this has oftentimes necessitated auxiliary experimental work, for example, the bureau has published methods of determining open hearth temperatures, and the research council has also taken this important problem up, which is being endeavored to be put on a more satisfactory basis. There is no trouble in actually measuring temperatures intermittently but there is considerable difficulty in devising a satisfactory routine method and in finding a suitable refractory. Another question in which the research council and the bureau have both been interested in is that of the question of sound ingot practice in steel works of the country. Committees are at work on both of these subjects. The bureau has also been able to continue its relations with the committees of the various technical societies, although it has not been able to aid in coöperation with these societies in as much experimental work as would have been desired. Again, a considerable number of metallurgical inventions involving new processes have been examined and passed on at the request of the interested department. In addition, a very heavy correspondence has been constantly maintained on metallurgical matters with the general public.

It is the desire of the bureau to develop to an even more intimate degree than it has been possible in the past, the closest technical relations with the various industries which produce products concerning which the Bureau of Standards can be of service in giving advice and carry on experimental investigations; for example, the "guild" spirit has been of necessity encouraged and fostered by the various committees of the War Industries Board, particularly the conservation division, in applying the restrictions to production that the exigencies of war have required. Certain constructive principles, however, stand out and it would be highly desirable to continue to benefit from the great economies that have been and can further be realized from the various applications of the principles of "standardization" in industry, including quality, types, packing, transportation, and many other items. Some of these desirable results can perhaps be best perfected by the organization of groups representing an industry and which, in cooperation with the government agencies such as the Bureau of Standards, can map out programs of industrial research, which without question will do much toward not only the advancement of knowledge in technical lines but also the accomplishment of important economics.

Water Cooled Equipment for Open Hearths.

(Continued from page 192)

the laboratory at what temperature the solids precipitate, and the outlet water should be kept from 10 to 15 degrees below this temperature. This may require using more water but insures a long life for the equipment and less trouble for the operator in cleaning it. If left to the furnace operators, there is usually much water wasted, as their interest is in the steel making and they do not have the time to watch the equipment closely. It is better practice to have a pipefitter look after the cooling devices to see that the outlet water is as hot as it can safely be used. When the installation is first made, he should give the apparatus very close attention for the first few weeks, starting with more water than is necessary and gradually cutting down the supply. By following this method it will be found that the minimum quantity of water will give the best results. Unless it contains a precipitate, there is no reason why the outlet water should not have a temperature of between 175 and 185 degrees.

Conclusion.

As stated at the beginning of this paper, water-cooling devices for open hearth steel furnaces should in general follow the lines used in iron blast furnaces. They should not, in a practical sense, be exposed on the inside of the furnace nor tend to slow up operations but should only absorb the heat that would otherwise be radiated in the air or be placed where they hold the brick covering and keep it hard enough to hold and thus increase the life of the furnace and keep it true to its best lines. The writer has not had the time to incorporate in this paper the history of the development of these and other water-cooled devices; this will make an interesting subject for a paper in itself. Many plant superintendents have devoted much thought to this subject and have developed equipment or contributed suggestions that have improved the devices herein illustrated.

Generated on 2024-09-08 14:02 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

FOREIGN RELATIONS

FOREIGN TRADE OPPORTUNITIES.

The following foreign trade opportunities are reported in the daily commerce reports. Reserve addresses may be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C., and its district coöperative offices. Request for each opportunity should be on a separate sheet and state opportunity number. The bureau does not furnish credit ratings or assume responsibility as to the standing of foreign inquirers; the usual precautions should be taken in all cases.

28463—The branch of an export commission firm of New York established in Venezuela desires to secure agencies from American manuacturers and solicits catalogs and correspondence. An office for the display of catalogs and samples has been fitted up, and competent salesmen are being secured.

28524—An engineer in France wishes to secure an agency for the sale of apparatus for low-tension and high-tension electric current, electric lamps, electric wires and cables, insulation tubes and equipment, electric motors and dynamos, electric meters, etc. He desires to establish a depot of electrical supplies. Correspondence should be in French. References.

28516—A firm in Scotland desires to purchase three inclosed-type, verticle, three-crank, condensing steam engines, speed not to exceed 350, steam pressure 160 pounds, coupled direct to 3,000-volt 500-kilowatt, 50-cycle alternator. Prices should be quoted separately for engine and generator, to be delivered at Cardiff, Wales.

28507—A man in Australia desires to secure an agency for the sale of electrical supplies and equipment, electrical apparatus for mines, shipyards, etc., and particularly electrical railway supplies. References.

28587—A firm in England desires to represent manufacturers and exporters, to act as sole buying agents, that is, to buy at a fixed price and sell at the best figures obtainable. wrought iron black and galvanized gas and steam tube and fittings, to conform in quality, screwing, sizes, and weight to that sold by all manufacturers in the British Tube Association. Terms, cash against documents through importer's bankers. Reference.

28571—A man in France wishes to secure an agency for the sale of tools, machine tools, metal saws, lubricating apparatus, faucets, ball bearings, and belts. Correspondence should be in French. Reference.

28577—An agency is desired by a man in France for the sale of machine tools, tools, steel, steel plate, chains, nails, bolts, screws, etc. Correspondence should be in French.

28595—A company in France wishes to purchase or to secure an agency for the sale of bolts, nuts, screws, nails, rivets, etc., and hardware. Correspondence should be in French. References.

28607—A firm in Syria desires to be put in touch with manufacturers in the export trade in red copper and brass in disks and bars, pine wood sawed for construction, iron and steel and other metallurgical products.

28625—A man in France desires to secure the representation of manufacturers of high tension insulators and metallurgical supplies. Correspondence should be in French.

28626—An enginer in Belgium desires to secure the representation of manufacturers of high tension insulators and metallurgical supplies. Correspondence should be in French.

28626—An engineer in Belgium desires to secure an agency from manufacturers for the sale in Belgium and northern France of ball bearings and roller bearings.

28653—A man in Denmark desires to secure an agency for the sale of steel products, such as beams, angles, channels, tees, ship channels, plates, iron and steel round bars, and tool steel; metal castings, electrical accessories, packings, armature, iron and brass cocks and valves, etc., railway equipment, cotton goods, such as sponge cloths and dust tarpaulin and Hessian, bunting, cotton fishing lines, packing, hemp ropes, manila ropes, and semy rotary pun References.

28666—A company in Norway desires to secure an age for the sale of wrought iron, T irons, channel iron, r plates for shipbuilding, etc., and iron and steel. Payn against documents in New York. Reference.

28697—A commercial association in Belgium wishes communicate with manufacturers of electric motors in o to establish business connections.

28714—A merchant in Italy desires to purchase and secure an agency for the sale of round rod iron, square profiled iron, homogeneous iron for use in reinforced crete, steel, iron tubes for gas and water, black and zin special pieces for such pipes, apparatus in general for gas water, plates, etc.; door and window hardware, technical terial, utensils in general, sanitary apparatus, faucets taps, and tools and instruments. Correspondence may in English. References.

IMPORTANCE OF THE FAR EASTERN TRADE

Eighteen per cent of the total trade of the United St including exports and imports, during 1918 was done the Far East. The imports from the Far East amounte $1,041,899,402 and exceeded those of any other grand divi representing 34 per cent of the total imports into the U States, while the exports to the Far East toaled $603,0 and were next to Europe and North America in volume, resenting 10 per cent of the total export trade of this cou

The Far East is rapidly coming into its own with rel to our foreign trade and the war should teach us the portant lesson that while we have been using Far Ea products for many years we have been buying them thr Europe, and with our own ships on the Pacific we may buy them direct. The benefits are apparent, for in add to building up Far Eastern credits in this country ag which Oriental merchants may draw, in the form of m factured goods, the tribute which we have paid for years to European shipowners and bankers for handlin Far Eastern trade for us will be diverted to our own co

In order to hold this trade, however, we should r nize the necessity and value of investing American c to building up Far Eastern credits in this country a only because these investments, especially in China profitable and safe, but also because our interests s be as great as European interests in trose countries trade follows the loan.

SWEDISH FIRMS DESIRE TO TRADE DIRECT W AMERICAN FIRMS.

(Consul General Albert Halstead, Stockholm, 191

Much eagerness is shown by many business firms to lish American connections. For this there are two re One is the depleted condition of all stocks in Swed the natural desire of each Swedish firm to be first market with needed supplies—the profit that will pany a firm's success in first furnishing this market w necessities need not be emphasized. The other reason desire of many firms to establish direct connection American manufacturers and not to import through countries. Many Swedish firms see no present neces having their goods shipped by way of another country adds to the cost through transit charges or through th

Generated on 2024-09-08 14:06 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

mission the agent requires for his services. These firms regard the Swedish market as large enough to warrant the direct connection, and many plan for trade in American goods with Finland and Russia. The advantages of the American shipping interests of direct shipments to Sweden of goods for Swedish consumption need not be emphasized.

NEW TONNAGE THAT MUST BE BUILT FOR DENMARK.

(Trade Commissioner Norman L. Anderson, Stockholm, Sweden.)

The Danish merchant fleet has suffered such serious losses during the war that a law was passed requiring all funds received by the Danish shipping companies as insurance for ships sunk to be reinvested in new tonnage to replace that lost. Besides an aggregate of 117,700,000 crowns received in insurance and which by law must be reinvested in new tonnage, it is estimated that these companies further have reserve funds to a total of several hundred million crowns, a good part of which will no doubt be invested in new tonnage.

Owing to lack of building material in Denmark and to the inadequacy of the Danish yards to build as quickly as desired, it is felt that most of this tonnage will have to be built abroad. The writer discussed this matter with one of the biggest shipping men in Copenhagen last week, and he said that the Danish yards could probably ultimately complete the required buildings, but that if the American yards would make contracts for six months to one year delivery, they could very likely get the orders.

NEEDS OF ITALIAN METALLURGICAL INDUSTRY.

(Weekly Bulletin, Canadian Department of Trade and Commerce, Ottawa.)

The Italian Metallurgical Association has recently issued a memorial in which is pointed out that the needs of the metallurgical industry cannot be indefinitely satisfied by the limited supplies of iron ore existing in the country, the inference therefore being that recourse must be had to foreign sources for the necessary raw and semi-manufactured materials.

Local Supplies of Iron Ore.

Prior to the war the iron mined in Italy came almost altogether from the Island of Elba and from there was taken to the blast furnaces at Portoferraio, Piombino, and Bagnoli. Thus, for example, in 1914, of the total tonnage produced in the kingdom, amounting to 706,246 tons, Elba yielded at least 649,561 tons. The mines of Valdaspra, in the Province of Grosseto (central Italy), yielded 36,000 tons, while the remainder was derived from the mines of Iglesiente (Sardinia) and Bergamasco (Province of Bergamo). Between 1909 and 1914, 2,500,000 tons of ore were mined in Elba and the production during the war has considerably increased. For example, in 1916 there were extracted from the whole of Italy 942,244 tons, and in 1917 almost 1,000,000 tons, the greater part in each year being of Elban origin. From now on, writes the Finanza Italiana, the Elba group cannot furnish large quantities under convenient conditions, as it will now be necessary to exploit the veins under the sea, with resulting greater costs.

The war, however, has stimulated researches for other ore deposits in Italy. Although in 1909 there was known to be high-grade iron ore in the Val di Cogne (near the French frontier), estimated at 6,000,000 tons, its exploitation was only recently begun by the well-known Ansaldo firm, which has installed electric blast furnaces modeled after Swedish types. Moreover, in the Nurra district of Sardinia the surveys made during the war have revealed the existence of about 6,000,000 tons of good iron ore. It is hoped, in fact, to utilize 150,000 to 200,000 tons a year from this source.

Estimated Italian Deposits—Need of Imports.

The following figures give the present estimated deposits of iron ore in Italy: Traverselle, 1,000,000 tons; Cogne, 5,000,000 tons; Central Italy, 2,000,000 tons; Sardinia, 6,000,000 tons; Val Brembana, 20,000 tons; total, 14,020,000 tons.

If the Italian manufacture of pig iron only maintains its production (about 400,000 tons annually), it is estimated that 700,000 tons of ore will be consumed per year and that in 20 years the Italian supplies will be exhausted. As a remedial measure it has been suggested that greater quantities of scrap iron and steel will have to be imported; the Metallurgical Association says at least 420,000 tons a year. In other quarters it is believed a better policy to bring the ore from abroad and make the pig iron locally.

But pig iron will also be and is in demand, and if the industrial program that Italy is drawing up is taken as a criterion, even large quantities of pig iron will be required than before or during the war.

GROWTH IN EXPORT TRADE OF UNITED STATES SHOWN BY COUNTRIES.

(Prepared by the Division of Statistics, Bureau of Foreign and Domestic Commerce.)

Increased exports to all parts of the world in January, 1919, as compared with 1918, are shown in a statement made public by the Bureau of Foreign and Domestic Commerce.

Of the $118,000,000 total increase in value, $36,000,000 went to Europe, $15,000,000 to North America, $30,000,000 to South America, $19,000,000 to Asia, $14,000,000 to Oceania, and $4,000,000 to Africa.

France and Russia are the only countries showing a decrease; exports to France fell off $40,000,000, and to Russia $3,000,000. Increases to the neutral countries range from $12,000,000 each for Netherlands and Spain, to $7,000,000 for Norway, $5,000,000 to Sweden, and $4,000,000 to Denmark. Exports to Belgium increased $14,000,000 and those to Italy and the United Kingdom $9,000,000 each.

Sales to Argentina increased $16,000,000; to Japan and Australia, each, $8,000,000; to Canada, Cuba, Brazil, Siberia, and the Philippines, each $5,000,000; and to other countries, from $1,000,000 to $3,000,000.

For the seven months ending January, 1919, as compared with the like period ended January, 1918, of the total exports of $3,800,000,000, over 60 per cent, or an increase of $163,000,000, went to Europe. North America received increased shipments amounting to $105,000,000; Oceania, an increase of $36,000,000; South America, $18,000,000; Asia, $17,000,000; and Africa, an increase of $9,000,000.

Trade with Russia for this period declined $111,000,000, and with Siberia, $22,000,000, while exports to Central America, Mexico, Cuba, and Brazil also show decreases of from $2,000,000 to $6,000,000.

Belgium shows the most striking increase during this period, its exports gaining $74,000,000 over the seven months ended January, 1918. Shipments to England also increased by an equal amount, followed by Australia and New Zealand with a gain of $26,000,000; Italy, $23,000,000; Japan, $15,000,000; Argentina, $12,000,000; China, $12,000,000; the Philippines, $10,000,000; France, $8,000,000, and other countries showing smaller increases.

Exports to all neutral European nations increased in the seven months ended January, 1919, Norway and Sweden leading with $17,000,000 each; Netherlands, $16,000,000; Spain, $14,000,000; and Denmark, $10,000,000.

Generated on 2024-09-08 14:02 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

Some Pointers on By-Product Coke Oven Operations

EFFECT OF "DIRECT" AND "INDIRECT" AMMONIA RECOVERY UPON OTHER BY-PRODUCTS*

By Thomas B. Smith.
Stocksbridge Coke Ovens, Sheffield.

PART I.

This paper completely disregards the "semi-direct" recovery plant, because of its complicating tendency to assume the advantages and disadvantages of both the "direct" and "indirect" proceses. The "direct" system is as yet the nearest step the coke-oven industry has taken towards the idealists "fractionation of the hydro-carbons in the tar main." The tar is brought down, at a temperature considerably above the "dew point" of many of the hydrocarbons, which in consequence are dephlegmated free from the heavier constituents, thus effecting a definite split. But many of the possible advantages of this have been neglected, the final effect being to remove a considerable portion of work from the tar distillery and to add it on to the already overburdened benzol rectification plant.

Tar.

This clean cut in the condensation of the hydrocarbons naturally has a drastic effect upon the tar, the viscosity of which is so great that in cold weather it is more like pitch. If a tar distillery is installed on the plant, the trouble is not so acute since by keeping the tar hot it can be easily handled; but where it has to be loaded into tanks and despatched by rail, considerable trouble arises in the emptying of the tanks, this necessitating dilution by the constant addition of thick oil from the benzol plant. It is, however, an excellent outlet for this substance, which is thus returned to the parent body, to make a normal tar, after having served an excellent purpose. Upon distillation, only a negligible quantity of benzol, its low-boiling homologues, and pyridine bases are obtained. A very poor yield of phenolic bodies is also noticed, the total yield of oils being from 40 to 50 gallons per ton of tar, and consisting of approximately 25 gallons of creosote and 20 gallons of anthracene oil, leaving a pitch residue of approximately 14 cwt.

Coloration of Sulphate of Ammonia.

The pink coloration of the surface of the salt is peculiar to the "direct" process. The two main suggestions are that (1) phenolic bodies and (2) cyanogen compounds are the cause of this coloration, and the author's experiments have fully proved the latter to be correct. Three common constituents of coke-oven gas are: (1) water vapor, (2) ammonia (3) carbon bisulphide. From these it is believed that ammonium sulphocyanide is formed, and this, on entering the saturator in the "direct" process, most probably before it is decomposed by the acid, forms a complicated compound with the iron, the latter being present as an impurity in the acid. An apparently white salt is obtained, but it colors quickly upon exposure to the air, due to the presence of slight traces of a blood-red ferric thiocyanate, the coloration of which, according to the ionic hypothesis, is due to the unionized molecule $Fe(CNS)_3$, since neither the ferric ion nor the thiocyanate ion is colored. The coloration is intensified if more ferric salt is added, the addition of a common ion causing part of the ionized salts to recombine to form molecules of the colored unionized ferric thiocyanate. This addition is caused by the gradual oxidation of the traces of ferrous sulphate always present in commercial ammonium sulphate. It is therefore obvious that the gradual intensification of the pink coloration is the immediate result of the gradual formation of ferric salts from the oxidation of the slight traces of ferrous sulphate.

In the case of the "indirect" plant, the ammonium sulphocyanide is washed from the gas at the ammonia scrubbers, or is recovered in the oxide purifiers, where these are in use. When the ammoniacal liquor is distilled with lime in the ammonia still, calcium sulphocyanide is formed, which passes away in the effluent, this being one of the most troublesome substances to deal with in the subsequent steps of the process.

Effluents.

It is not unusual to hear the "indirect" plant spoken of as "the process with an effluent," and the "direct" plant as "the process without an effluent." Although most people connected with the industry understand these sayings, they are literally very incorrect. When carbonizing wet coal containing about 10 per cent of moisture, approximately 22.4 gallons of water have to be got rid of for every ton of coal carbonized, no matter what process of ammonia recovery is in use, although in the "indirect" plant the quantity is considerably increased by the milk of lime and the steam condensed in the ammonia still. The two effluents, (1) the well-known waste liquor from the ammonia still and (2) the condensings from the gas at the cooling plant, after the saturators on the "direct" plant, are, however, of a widely different character, as a comparison will readily show:

1. The spent liquor has first to be allowed to settle, in order to recover the "lime mud"—a most troublesome and useless substance. The clear liquid is a constant source of trouble. It is usually discharged into the nearest stream or sewer, and occasionally causes serious nuisance, when it comes into contact with other effluents and evolves deleterious gases. The ingredients of the clear liquid have been proved to interfere considerably with the bacteriological treatment in the purification of sewage. The most serious constituents are the sulphocyanides, the percentage of which, it is hoped, will be diminished when the industry has developed to such an extent as to consider the recovery of cyanogen compounds as important as the recovery of ammonia. In some cases the effluent is used for coke quenching, the result being that the coke has a very bad appearance.

2. An analysis of the condensate taken from the coolers of a Simon-Carves "direct" plant shows that the greater portion are gaseous or easily volatile substances. It may therefore properly be used for the quenching of coke, the appearance of which is as good as when quenched with fresh water.

Cooling Plant.

The naphthalene trouble of the cooling plant with the "direct" process is exceptionally great. By using a suitable preventative, however, the condensers can be kept clean for as long a period as with the "indirect" process. The napthalene (the "dew point" of which varies according to the humidity of the gas, but is generally in the region of 30–40 degrees C.) is deposited on the tubes of the condenser.

(To be continued.)

*Abstract from Iron and Coal Trades Review of paper read at Sheffield on December 21 before the Coke Oven Managers' Association (Midland Section).

Generated on 2024-09-08 14:04 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

NEWS OF THE PLANTS

The Milliken Brothers Manufacturing Company, Inc., olworth Building, New York, is making substantial gress in the establishment of its new steel fabricating nt at One Hundred and Thirty-sixth street and East River. ls have recently been taken for considerable equipment to installed at the works, including punches, shears, horital bending machine and other apparatus to be used for production of steel shapes. The plant will be fully ipped in all departments for the production of shapes for l transmission towers, radio towers, and special one-story steel buildings, known as the standardized truss unit tem. Plans have been filed for extensions and improveits in the existing building, formerly used by the James Young Stone Company, to cost about $28,500. The comy has laid plans for a particularly active year, including h domestic and foreign business, and will develop its it to a capacity to provide for all demands. C. T. Clack resident, and J. E. Jennings, vice president.

The Trumbull Steel Company, Youngstown, O., is now rating 13 sheet mills, 19 tin mills, as well as two jobbing ls and strip mills at its plant and plans for active protion during the coming year. Employment is now being en to about 5,000 men in the different works departments.

The Republic Iron & Steel Co., Youngstown, O., is adding ip hoist to its No. 2 Haselton blast furnace, converting a hand-filled to a mechanically operated stack. The ace will also be relined and repaired, with capacity inced to about 425 tons. Construction is well under way new boiler plant at the works, to provide additional r for operation.

he Sligo Iron & Steel Company, Connellsville, Pa., is hing for extensions in its works to increase the capacity total of about 5,000 tons a month. The company specialin the production of iron and steel bars.

he American Manganese Manufacturing Company, Bullitt ding, Philadelphia, Pa., has inaugurated operations at its 1 blast furnace, following extensive improvements and ions during the weeks past. A new complete skip e has been constructed, a new hoisting engine installed, new direct discharge coke system; the furnace top struchas been reconstructed, including a new distributor. company has also recently made improvements in its 2 blast furnace, to increase the operating facilities at Dunbar, Pa., works. Plans are now being considered urther extensions and improvements at the plant for ged output. S. T. McCall is secretary and treasurer.

ie Texas Steel Company, Beaumont, Tex., is making progress in repairs and improvements at its Rusk furnace, and plans to blow in the plant at an early The work now nearing completion is estimated to $75,000, and will greatly facilitate operation.

ie Jones & Laughlin Steel Co., Pittsburgh, Pa., has plans for extensions to its works at Hazelwood to about $114,000. The work will consist of a new boiler to cost about $75,000; electric station to cost $22,500, former station; acid works, and pumping plant. The ures will form a new group of buildings on Long- street, near Second avenue, and will be used to in- the operating facilities at the plant. The Vesta Coal any, a subsidiary organization, has completed the on of new marine ways at Floreffe, on the MonongaRiver, about 25 miles from Pittsburgh. The ways comprise six steel cradles, with capacity to hoist a 250-ton barge. The plant is electrically operated in all departments, and represents an investment of about $700,000.

The Central Steel Company, Massillon, O., has completed the construction of extensive additions to its plant to increase the operating facilities. The work includes improvements to the boiler plant, with the installation of new equipment including stokers, coal and ash handling plant, and water purifying system. The company is planning for the early completion of an extension to its gas producer department to comprise 23 new gas producers, and two new soaking pits.

The Wheeling Steel & Iron Co., Wheeling, W. Va., is planning for extensive operations at its various plants during the coming year. Six of the 24 mills at the Yorkville works have now been reopened for the production of tin plate, giving employment to close to 2,000 men. It is planned to inaugurate operations at the other mills at an early date. During the past year, the company has made numerous additions to its Martins Ferry, Belmont, and Benwood plants, including the installation of a new auxiliary blowing engine and boiler, with relining of stacks and miscellaneous work at the first mentioned furnace. At the Belmont plant, an extension has been built to the No. 2 crane runway, and improvements made in the gas producer department. At the Benwood plant a new cupola and crane runway, as well as charging system, was completed. At this last noted works, the company will build a one-story addition, about 50x100 feet.

The Canton Sheet Steel Company, Canton, O., is planning for extensive improvements at its works during the coming year for increased output. Building contracts have recently been let for a new 18-inch bar mill, and plans are being considered for the installation of a 90-ton furnace during the coming year to replace the two 30-ton units now in service. This will increase the capacity of the plant to 150,000 tons. The company is now operating a three-high continued sheet bar and billet mill for the production of sheet bars, billets and slabs for the sheet mill department at the works. During the past year one of the 30-ton open hearth furnaces was replaced with a 90-ton unit, and this is now being operated at capacity. The company is affiliated with the Cleveland Welding & Manufacturing Co., Cleveland, O., and the majority of its output is used by this interest.

The Carnegie Steel Company, Pittsburgh, Pa., is making improvements and repairs at its finishing mills at Sharon, Pa. The work is expected to be completed at an early date. During the past years this plant has maintained continuous operation at maximum production, and immediately following repair work will again be placed in service at regular capacity. The company is planning for the immediate rebuilding of the pattern shop and woodworking plant at its works at Farrell, Pa., destroyed by fire early in March, with a reported loss of about $65,000. It is understood that in the reconstruction considerable new equipment and machinery will be acquired to facilitate every feature of operation.

The Cambria Steel Company, Widener Building, Philadelphia, Pa., is operating a large section of its works at Johnstown, Pa., for government service. For the next few months the company will build standard steel hopper cars for the Pennsylvania Railroad as per orders received from the United States Railroad Administration

Generated on 2024-09-08 14:04 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

INDUSTRIAL RELATIONS

FACING THE ISSUE.

By J. R. Shultz
Managing Editor, Du Pont Magazine.

Enthusiasm in the hour of triumph often impels the utterance of statements that are ill judged and extravagant. Nations, like youths, when they have measured strength with opponents and won the victory, are aroused to a consciousness of latent abilities and in the moment of discovery tend to overestimate their power.

The discovery of our power and the successful issue of the recent struggle caused enthusiasts to proclaim that America will henceforth be industrially independent.

This is a generality which, like the word "liberty," electrifies every American. If it be supposed, however, that industrial independence means self-sufficiency, or freedom from restraint, or the possession of some subtle superior attribute which will give us absolute supremacy, the statement is greatly in error.

No nation can be at once self-sufficient and economically progressive. The chief source of national wealth consists in the possession of excess satisfaction, and this wealth is to be realized only through the sale or exchange of these satisfactions to supply the wants of other nations—that is to say, through economic relations with foreign countries.

During the war the United States has had an excess of military supplies because of the manufacture of our raw materials into munitions. This market for military supplies, we are glad to say, no longer exists, but we shall not allow our new-found energy to dissipate itself in mere rejoicing. We shall turn it upon the problem of repairing the ravages of war and of maintaining America in that high place among nations to which our war activities have raised her.

To do this, to increase our wealth and secure industrial leadership for the United States, we must possess an excess of diversified supplies and must find markets for them abroad. To this end American commerce must be extended; intercourse and exchange with other countries must be fostered. We shall need to import certain materials, and we cannot demand payment in gold for all our exports. We must be ready to make a fair bargain, for with nations as with individuals the maintenance of satisfactory economic relations is dependent upon a reciprocity of interest. To assume that we are nationally free to dictate the terms of commercial intercourse simply because, for example, we have thrown off the shackles of German domination in the potash and dye industries would be calamitous.

We shall have to exercise care that we do not in our present advantage over our allies transcend our rights, and we must recognize that competition, which is the law of life, will revive and become astonishingly keen.

We must understand clearly that the economic leadership which we hope for is to be gained, not through exclusion and domination, but through the development of closer trade relations with other countries on a basis of fairness and superior commercial service.

The cessation of war production is bound to throw out of employment thousands of men and women. Indeed this result began to manifest itself the very day the armistice was signed. Both capital and labor will find themselves in a new position and both must adapt themselves to changed conditions that inevitably arise in industry during the transition from progress on a war basis to progress on a peace basis. The unprecedented wage rates imposed upon the manufacturer during the war will fall in accordance with the fundamental economic law that wages vary in inverse ratio to the supply of labor. But a precipitous return to the pre-war wage scale would work great hardship upon the laborer because prices of commodities will tend to come down much less rapidly. The demand for great quantities of foodstuffs for export, the high transportation rates, and the fact of seasonal production will all work together for sometime to keep up the price of food.

The employer of labor must take these facts into consideration in reducing wages. He must forego a portion of his profits to aid in preventing too great a disparity between wages and the cost of living. This is a necessity for the prevention of labor difficulties and for the harmonious expansion of the manufacture of peace products. The employer must be brought to see its justice and its wisdom.

The laborer, on the other hand, must learn to see himself in relation to the general economic situation. He must realize that his war earnings were abnormal, and that the return of the soldiers to civilian occupations and the cancelling of war contracts will increase the supply of labor and decrease its market value. He must content himself with less for the present in the knowledge that prices will gradually become commensurate with lowered wages.

MODERN STEAM POWER STATION EQUIPMENT.

(Continued from Page 182)

the coal that was originally contemplated, very little difficulty was encountered with clinkers. Performance results are shown in Fig. 14, when a grade of coal with the following analysis are used:

Fixed carbon	41.0
Volatile	29.0
Moisture	9.0
Ash	21.7
Btu (dry)	12,000

considerable more attention was required to keep the fires uniform and cleaned properly in order to decrease clinker trouble to a minimum.

Denver Gas & Electric Co.

Recent developments in the West have brought about the installation of underfeed stokers for burning coals found in the Denver markets. The above company's new extensions contemplates the installation of four 750 hp boilers and four 9 retort underfeed stokers. The application setting worked out as shown in Fig. 15, was made to give sufficient combustion space for any high volatile coals that were liable to be used at this plant, including lignite. The fuel-burning equipment has been designed for the following coals:

Fixed carbon	39.00
Volatile	35.85
Moisture	19.70
Ash	5.37
Sulphur	0.42
Btu (dry)	12,000

When using the above fuel, the operating performance ranges from 140 per cent boiler rating to 200 per cent boiler rating for short duration, with approximately 70 per cent combined boiler and furnace efficiency.

Generated on 2024-09-08 14:16 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

PRODUCTION TOPICS

MEETING METALLURGICAL CORPORATION.

At the annual meeting of the American Metallurgical orporation, Franklin Trust Building, Philadelphia, held ring the past month the following changes in executive ontrol were made:

S. R. Vanderbeck was re-elected as president.

F. J. Ryan was elected to position of vice president and easurer, also to continue as general manager.

S. R. Vanderbeck was re-elected as president.

Changes in the management were as follows:

F. H. Shaw, who had been in charge of purchases and ccounting goes to the plant at Conshohocken, Pa., as office anager, while James L. Hawley, recently auditor for Sax-an Coal & Coke Co., Philadelphia, Pa., succeeds Mr. Shaw.

T. B. Bechtel becomes superintendent of construction.

H. A. Horner, recently of the Midvale Steel & Ordnance o., will be in charge of the metallurgical department.

H. A. Morlock, formerly in charge of heat treating equip-ent at the Watertown arsenal will have charge of equip-ent operation.

The report of the general manager shows a very success-l year. New business on hand includes additions to the rcraft plant at Shelby, O., 15 Ajax-Wyatt brass furnaces r the Ajax Metal Company and special heat treating in-stigations for the Ball Rolled Tube Company of New York.

Additional land had been secured at Conshohocken, Pa., d contracts are being let for the installation of a practical erating furnace laboratory where experimental heats up to 0 pounds can be taken off under ideal conditions to obtain actical deductions.

ENGINEERING ADVERTISERS ASSOCIATION FORMED.

Advertising and sales managers representing manufac-ers in various engineering lines have felt the need of an sociation where free discussion might be given various oblems that arise in their field of endeavor, and also per-t means of friendly interchange of ideas and business thods pertaining to the advertising and selling of en-neering products.

With these objects in view, the Engineering Advertisers sociation was organized in Chicago, March 11, at the otel La Salle. At that meeting some of the leading manu-turers of engineering products were represented, a con-tution and bylaws adopted and officers and directors cted as follows:

President, H. L. Delander, advertising manager Crane mpany.

Vice president, H. Colin Campbell, director advertising rtland Cement Association.

Secretary, G. H. Eddy, publicity manager Green Engi-ering Company, East Chicago, Ind.

Treasurer, Edward J. Pratt, advertising manager Kellogg itchboard & Supply Co.

Board of Directors

For One Year.

G. S. Hamilton, advertising manager American Steam nveyor Corporation.

J. J. Arnsfield, advertising manager Fairbanks Morse o.

A. P. Hauck, director of advertising Allis-Chalmers Manu-turing Company, Milwaukee.

For Two Years.

H. W. Clarke, advertising manager, Chicago Pneumatic ol Company.

P. A. Powers, advertising manager, Benjamin Electric nufacturing Company.

J. C. Kinsley, secretary A. M. Davis Regulator Company.

Membership Committee.

Albert H. Hopkins, advertising manager C. F. Pease Company.

H. W. Stannard, president Twin Fire Furnace Company.

W. L. Schultz, sales manager, James A. Brady Foundry Company.

The Engineering Advertisers Association will be dominated by its active membership, although provision is made to accept as associate members, publishers and their representatives, solicitors and service agency men whose interests are confined to engineering projects. Active membership, however, can be enjoyed only by those in responsible charge of advertising or sales of the companies with which identified. Regular meetings of the association will be held monthly except during July and August, the annual meeting being held in March. Speakers of recognized prominence in the field of engineering advertising will give addresses on the subject of general and special interest to members at various meetings.

NATION'S GEAR MAKERS TO MEET AT CLEVELAND

President F. W. Sinram, of the American Gear Manufacturers Association announces that their annual convention will be held at the Hotel Statler, Cleveland, O., April 14, 15 and 16.

The organization includes in its membership representative companies engaged in making gears in the United States and Canada and promises to be of unusual interest to the manufacturing world. For some years past the American Gear Manufacturers Association has been striving earnestly to affect an organization that would develop definite means for standardizing their products. The coming convention will center its attention on this problem.

Papers will be presented as follows:

(1)—"Gear Steels," by Dr. Parker of the Carpenter Steel Company.

(2)—"Proper Sizes and Materials for Gears."

(3)—"Worms and Worm Wheels," by a representative of the Timken-Detroit Axle Company.

Officers of the association are: President, F. W. Sinram, of the Van Dorn & Dutton Company, Cleveland, O.

H. E. Eberhardt, vice president of the Newark Gear Cutting Machine Company, Newark, N. J.

Frank D. Hamlin, secretary of the Earle Gear & Machine Co., Philadelphia, Pa.

Frank Horsburgh, treasurer of the Horsburgh & Scott Co., Cleveland, O.

STATEMENT OF OWNERSHIP, MANAGEMENT, ETC., OF

The Blast Furnace and Steel Plant

[Required by the Act of Congress of August 24, 1912]

Name of Publication: **The Blast Furnace and Steel Plant**, published monthly at Pittsburgh, Pa. [Report for April 1, 1919.]

Publisher—National Iron and Steel Publishing Company, 108 Smithfield street, Pittsburgh, Pa.

Managing Editor—Herbert A. Andresen, 108 Smithfield street, Pittsburgh, Pa.

Engineering Editor—Alfred M. Stuehle, 108 Smithfield street, Pittsburgh, Pa.

Business Manager—Fred C. Andresen, 108 Smithfield street, Pittsburgh, Pa.

(Names and addresses of stockholders holding 1 per cent or more of total amount of stock):

Herbert A. Andresen, 108 Smithfield street, Pittsburgh, Pa.

Fred C. Andresen, 108 Smithfield street, Pittsburgh, Pa.

Known bondholders, mortgagees, and other security holders, holding 1 per cent or more of total amount of bonds, mortgages, or other securities: None.

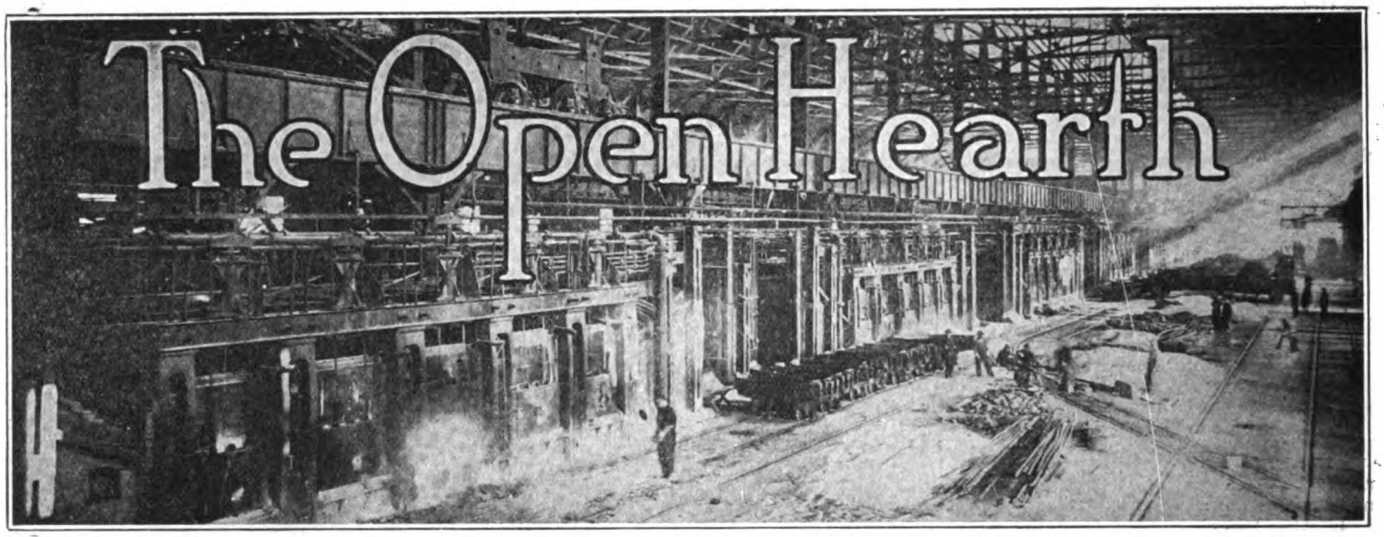
FRED C. ANDRESEN, Vice President and Treasurer.

Sworn to and subscribed before me this 26th day of March, 1919.

JOHN N. ENGLISH, Notary Public.

(My commission expires March 9, 1923.)

Generated on 2024-09-08 14:16 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO



C. W. Johnson has been appointed assistant manager of works of the Westinghouse Electric & Manufacturing Co. After graduating from Ohio State University, Mr. Johnson entered the employ of the Steel Motor Company of Johnstown, Pa. A year later he became associated with the Bullock Electric Company of Cincinnati, O., and in 1904 was made superintendent of the Allis Chalmers Bullock, Ltd., of Montreal, Can. In 1907 he entered the employ of the Westinghouse Company, later being appointed general superintendent, in which capacity he served until his recent appointment. Mr. Johnson is a member of the American Society of Mechanical Engineers, American Institute of Mining Engineers and Engineers' Society of Western Pennsylvania.

V V

George E. Thackray, C. E., of Johnstown, Pa., has been appointed by the president of the American Institute of Mining and Metallurgical Engineers, as one of their members on the American engineering standards committee.

V V

Frank Hodson, president of the Electric Furnace Construction Company, returned from Europe, February 24, accompanied by Harry Etchells, one of the inventors of the Greaves-Etchells furnace. Mr. Etchells, during his short stay in America, is to act in an advisory capacity on the latest European practice.

V V

R. W. Heffner, who has been employed by the United Furnace Company of Canton, O., for the past three years, in the capacity of superintendent of the by-product coke plant, has resigned his position to take charge of the plant now being erected by the Rainey-Wood Coke Company, Swedeland, Pa.

V V

C. M. Smith, president and treasurer of the Colonial Iron Company, who has for some time been in Florida, has again returned to take up active work.

V V

Grant J. Woolston is now connected with the Aborn Steel Company. He was formerly associated with the Fulton Steel Corporation, Fulton, New York.

V V

John J. Davison is now superintendent of the Downingtown Manufacturing Company foundry, at Downingtown, Pa.

V V

John C. Neale, S. M. Vauclain and D. Brewer Gehly were elected directors of the Cambria Steel Company, Johnstown, Pa., at its recent annual meeting.

Edward A. Miller is now assistant superintendent of the Jersey City plant of the Metal & Thermit Corporation, New York City.

V V

G. H. Parm, general manager of the concern of Josef F. A. Comstedt, iron and steel exporters, is taking an extended trip to Norway and Sweden.

V V

E. J. McGinniss is now connected with the Weirton Steel Company, Weirton, W. Va. He was formerly in charge of the blooming and plate mill at the LaBelle Iron Works, Stenbenville.

V V

E. A. S. Clarke has left for a trip to Europe to study business conditions in the interest of the Consolidated Steel Corporation.

V V

Dudley R. Kennedy, formerly with the Youngstown Sheet & Tube Company and manager of industrial relations for the American International Shipbuilding Corporation, has opened an office as practical advisor of industrial relations problems, Real Estate Trust Building, Philadelphia.

V V

Frank M. Welsh is now resident manager in charge of the New York office of Hickman, Williams & Co., Inc. He was formerly connected with the Vulcan Steel Products Company, Republic Iron & Steel Co., Spang, Chalfant & Co., Inc., and the National Tube Company.

V V

John Bindley, who has had many years of active connection with the steel industry and the hardware field, was recently elected president of the Pittsburgh Steel Company.

V V

Robert A. McDonald is now general superintendent of the Pittsburgh Crucible Steel Company, Midland, Pa. Mr. McDonald was formerly superintendent of the Crescent works, Crucible Steel Company of America.

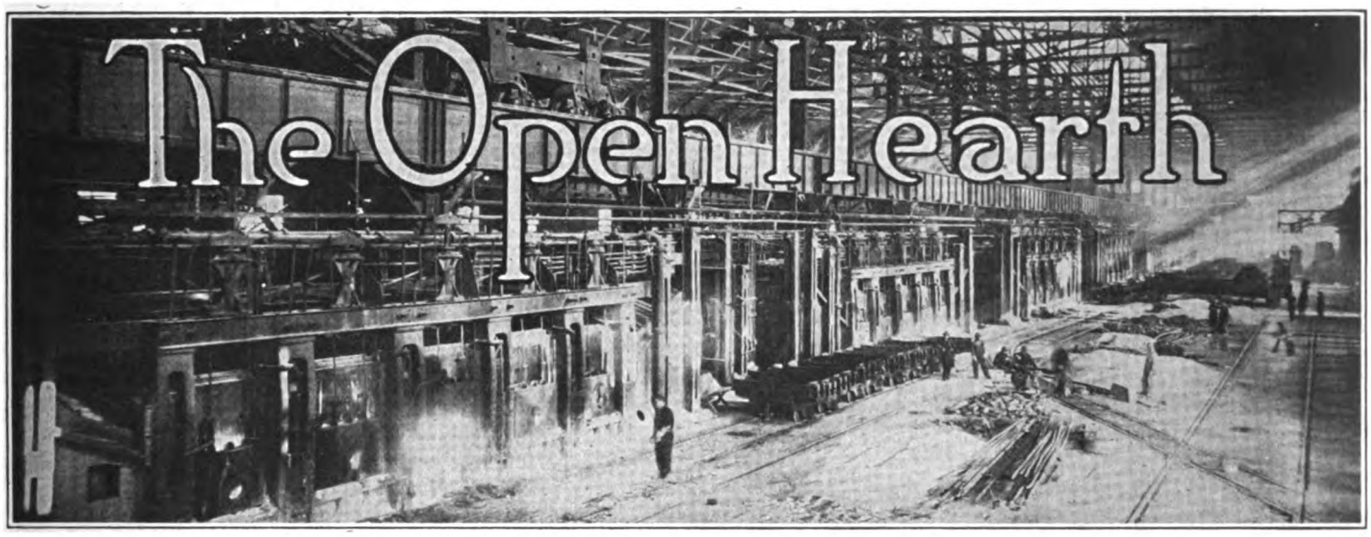
V V

James Farrell is now head of the industrial relations department of the Worthington Pump & Machinery Corporation, having resigned a similar position with the Bethlehem Steel Corporation.

V V

H. L. Mentser, formerly manager of the Far Eastern department of the Vulcan Steel Products Company, is now connected with the Parker Company. Mr. Mentser was formerly connected with the Midvale Steel & Ordnance Co.

Generated on 2024-09-08 14:06 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO



John H. Adams, formerly general manager of the Birmingham Trussville Iron Company, has opened a consulting engineering office in the American Trust Building, Birmingham.

V V

Charles Schenck is now production engineer of the Bethlehem Steel Company plants, Bethlehem, Pa. He succeeds H. S. Vance, who has resigned.

V V

C. H. Foster formerly secretary and treasurer of the Superior Steel Corporation, of Pittsburgh, has been appointed president and treasurer of that company.

V V

L. E. Thomas, formerly vice president and general manager of the Birdsboro Steel Foundry & Machine Company, has been elected president and director of the Reading Iron Company, succeeding F. C. Smink, who becomes chairman of the board of directors.

V V

W. C. McGaffic has opened a consulting engineering office in the B. F. Jones Building, Pittsburgh. Mr. McGaffic will specialize in blast furnace work as well as structural steel and plate work.

V V

John R. Foster, formerly connected with the Iron & Fuel Trading Company, Pittsburgh, is now manager of sales of the ingot mold department of the Valley Mould & Iron Corp.

V V

Malcolm R. MacLean, recently in the service and formerly manager of the Pittsburgh district of the American Steel Foundries, is now sales manager of the Duquesne Steel Foundry Company, Pittsburgh.

V V

J. H. Bache has recently been elected a director of the Empire Steel & Iron Co. Catasauqua, Pa.

V V

J. E. Daily, general superintendent of the Lowellville mills of the Sharon Steel Hoop Company, has resigned, due to ill health.

V V

G. Walter Esau, president of the Modern Steel Foundry Company, Milwaukee, was recently elected president of the Milwaukee chapter of the American Steel Treaters' Society. Charles J. Wesley was elected secretary and treasurer.

V V

D. E. Sawyer is now manager of the steel department of the J. E. Dockendorff & Co. export and import concern, New York. Mr. Sawyer was formerly affiliated with the Illinois Steel Company, Chicago.

Clarence W. Andrews is now connected with the American Steel Foundries in Alliance, O., as chemist in the open hearth department.

V V

Charles Donley, superintendent of the hot bolt department of the Lebanon, Pa., plant of the Bethlehem Steel Company, is now department superintendent at the Lebanon Valley Iron & Steel Cc Lebanon Pa., succeding Charles Hopkins, who resigned.

V V

W. H. Basse is now manager of the Detroit plant of Joseph T. Ryerson & Son.

V V

Ralph J. Stayman is now connected with the Jones & Laughlin Steel Company. Previous to his entrance in the ordnance department he was manager of the Detroit plant of Joseph T. Ryerson & Son.

V V

W. M. Henderson has been appointed superintendent of the William Wharton, Jr. & Co., Inc., plant at Easton, Pa. Mr. Henderson was formerly connected with the Pennsylvania Steel Company, Steelton, Pa.

V V

F. C. Elder has been appointed metallurgist of the American Steel & Iron Company, with offices in the Frick Building, Pittsburgh, succeeding S. M. Rogers, deceased. Mr. Elder was formerly in charge of the physical testing laboratory of this company at Cleveland.

V V

James Williams has been appointed assistant superintendent of the Central furnaces of the American Steel & Wire Co., Cleveland. He was formerly general foreman. Mr. Williams succeeds C. S. Farkum, who is now superintendent of blast furnaces at Donora.

V V

L. T. Harper, formerly connected with Byron Jackson Iron Works, San Francisco has just returned from India and opened an office for the export of machinery, in the Mills Building under the name of Shields-Harper Company.

V V

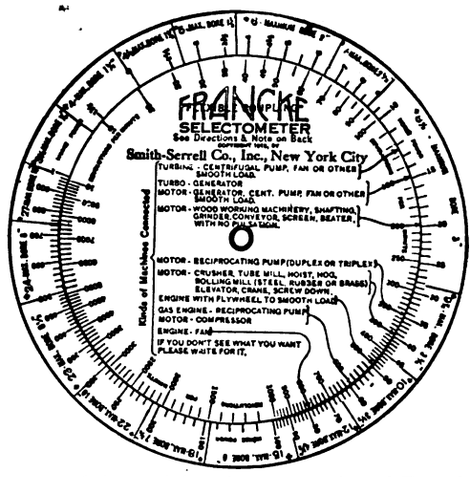
James M. Woltz, safety director Youngstown Sheet & Tube Co., Youngstown, O., was elected chairman of the Society of Ohio Safety Engineers, at the fourth annual meeting held recently in Cleveland. A. C. Cook, of the Carnegie Steel Company was chosen vice chairman; E. R. Rose, Republic Iron & Steel Co., secretary and treasurer; and Wallace Dunn, Republic Rubber Company, assistant secretary and treasurer.

Generated on 2024-09-08 14:06 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

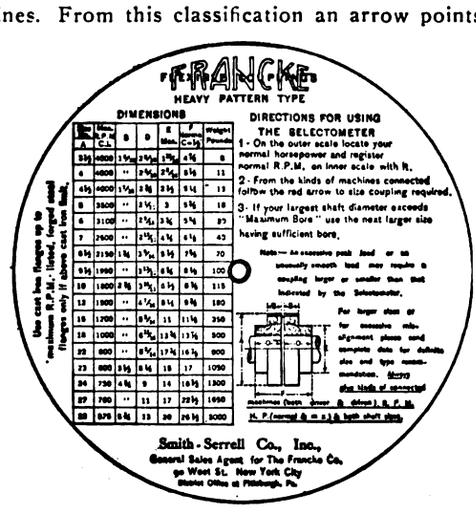
WITH THE EQUIPMENT MANUFACTURERS

SELECTOMETER FOR COUPLINGS.

The Smith-Serrell Company, Inc., 90 West street, New York City, have designed and made available a very convenient device



for the purpose of determining the proper size of Francke flexible couplings for any given device. In order to use the selectometer for computation, the normal hp and rpm must be known. The hp is registered on the outer scale with the rpm on the inner scale. The proper selection is then made from the list of classifications of machines. From this classification an arrow points to the



number of the proper coupling and at the same time gives the maximum bore. The back and front of the selectometer is shown in the accompanying illustrations. These selectometers are available and can be secured from the above company.

TEMPERING AND HARDENING STEEL.

The lost art of tempering has been as great a bar to progress as any one element we have had to contend with, and we have all looked forward to chemistry to solve the problem

The distinction between hardening and tempering is one of degree only, and both are of an opposite character to annealing. Hardening in the shop sense signifies the making of a piece of steel about as hard as it can be made, while tempering indicates some stage in an infinite range between the fully hardened and the annealed or softened condition.

It has been a long established practice to estimate temperature by color tints, but this is being rapidly invaded by new methods in which the temper-heat is obtained in furnaces, provided with pyrometers, by means of which the heating-up is done gradually. Such furnaces are used for hardening balls for bearings, cams, small toothed wheels, and similar work, as well as for the tempering of springs, milling cutters, and other kinds of cutting tools. But for the cutting tools having single edges as used in engineers' shops and blacksmith shops, the color test is most generally used, and in the hardening and tempering of tools by color, experience is the only safeguard.

The most difficult articles to harden are springs, milling cutters, taps and reamers. Hardening is performed the more efficient the more rapidly the quenching is done, most generally there is danger of cracking, especially is this true of the thick objects. Rapid hardening is usually the cause of distortion of long taps and reamers, and of their cracking. Almost every class of tool requires a different temperature or tint.

Case hardening is employed where toughness must be combined with durability of surface and has usually entailed more careful handling and attention than any other class of the hardening process. Results are obtained by converting the surface of the article into steel and then hardening these surfaces, but it is necessary to heat the articles to correct temperature, and the surfaces must be treated with some carbonizing material. The hardening point or temperature of tools made from different brands of tool steel, may, by experience, be located with accuracy.

Some industries have been very slow to adopt the more efficient methods for the proper hardening and tempering of tools, and yet, taking the industry as a whole, it is believed that they do more tempering and hardening of tools, than any other single industry in the country. With them the open furnace and water is the most common for tempering, while some have adopted oil baths for high speed steel. There are numerous compositions for hardening and tempering which have met with more or less success. A chemical compound manufactured by the Empire Chemical Company is adapted for use as a tempering and case hardening purpose. Most generally these two processes require separate baths to produce good results.

A noteworthy improvement in the design of the Sterling wheelbarrow is the new 10-spoke wheel. The fact that all other wheelbarrow wheels have eight spokes and the Sterling wheel has 10 spokes presents a big credit for Sterling, as any user of wheelbarrows will readily realize that by adding two additional spokes to wheel construction, it will greatly strengthen the weakest part of the average barrow. The Sterling wheelbarrow is manufactured by the Sterling Wheelbarrow Company, of Milwaukee.

PAMPHLET DISCUSSING EXPORT LAW.

Benjamin Catchings, director of the Foreign Trade Bureau of the Federal Trade Commission, has issued a pamphlet for distribution to interested persons. This pamphlet deals with the practice and procedure under the Webb-Pomerene export trade act.

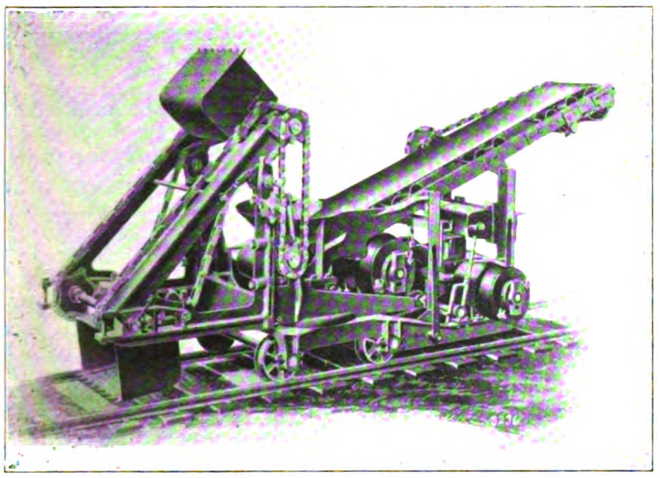
Generated on 2024-09-08 14:05 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

WITH THE EQUIPMENT MANUFACTURERS

THE M'DERMOTT CONTINUOUS TWIN SCOOP LOADER.

After several years of development work, the Wellman-Seaver-Morgan Company of Cleveland, O., has placed upon the market a mine loading machine known as the McDermott Continuous Twin Scoop Loader. As its name implies, this machine digs loose ore, dirt or muck by a continuous scooping process, the material being taken up by scoops or buckets on an endless chain elevated and dropped into a hopper which feeds to a conveyor belt which in turn loads into a car. The accompanying illustration clearly brings out these points. The scooping mechanism is so pivoted that it can dig to the side as well as in front of the machine. The ore, however, being delivered to the conveyor through the hopper, reaches the car behind the loader no matter at what angle the scoop is working. The movement of the scoops is continuous, not reciprocating.

The machine is self-propelled and is so dimensioned that it can easily be transferred around the mine. It will load



McDermott Continuous Twin Scoop Loader.

at the rate of over a ton a minute and may be operated by unskilled labor.

In designing this loader, the adverse conditions and restricted space incident to underground mining have been kept in mind and particular attention has been given to rigidity with minimum weight. It is compact, durable and simple of operate. It is essentially a labor saving, time saving device—removing the drifts quickly and allowing the drillers to get to the headings more often.

While specially designed for underground work, the loader is not limited to this application as it can also be used on the surface for loading coal from piles to cars, removing piles of rock and sand and similar operations.

The loader consists of three main parts—truck, digging head and conveyor. These parts can readily be dismounted and as readily reassembled, permitting ease of handling in getting the machine underground and in shifting from level to level.

The levers for operating the loader are located at one side in a position convenient for the operator to see the several movements. He simply has to keep the machine well up to the pile and swing the shovel from side to side of the drift.

The loader is fitted with motors wound for 230 volts, dc, providing power for all of the operations. The motors are of the entirely enclosed type and all chains and gears are protected with suitable guards.

The entire framework is of steel, the digging head is mounted on a large ball bearing, and all parts are protected as much as possible against dirt and water. All chains are provided with take-ups and the digging edge of the bucket is filled with renewable tooth sections.

The general dimensions of the loader are as follows:

Maximum over all length	15′9″
Maximum over all height	5′6¾″
Max. over all height with bucket in lowest position	6′7½″
Max. over all width when machine is in operation	4′
Gauge of truck wheels	24″
Max. rated capacity with full buckets, tons per min.	1.75
Average capacity, tons per hour	45
Weight of complete machine, pounds	8,000

STRUCTURAL STEEL FOR SHIPS.

Carnegie Steel Company of Pittsburgh has just announced that the second edition of its pamphlet, "Structural Steel for Ships," is now off the press and ready for distribution. It contains 60 pages instead of 16 as in the first edition and includes many additional tables. A commentary has been added which is an elementary discussion of rolling mill practice and steel works procedure as related to the manufacture and shipment of ship steel and reflected in the American standard practice.

This pamphlet is of great value to the ship builder because it is the latest word on the subject of structural steel for ships and contains a great store of information and working data.

The booklet gives tables on structural shapes recommended for ships and includes angles, channels, bulb angles, weights of flat rolled steel, permissible variations of plates ordered to weight, permissible overweights of plates ordered to thickness, elements of equal leg angles, elements of bulb angles and elements of channels. It also includes facsimiles of standard order forms for shapes, plates and bars.

The commentary describes and illustrates the kinds of rolling mills utilized in the manufacture of ship steel, traces the route followed by an order from a ship yard, through district and general offices to the mills, through the mills to the shipping beds and thence back to the shipyard. It thus explains fully in what way irregularities in order practice complicate and delay the manufacture of ship steel and how the adoption of standardized practice benefits both the shipyard and the steel maker. It also recommend a convenient and uniform system for cargo vessel materials and a practical method of plain material storage at the yards—all fully illustrated by diagrams and figures.

If the recommendations in this pamphlet are followed, a long step forward will have been taken in the standardization of shipyard order practice and that will lessen if not wholly remove the delays which have often occurred in the actual placement at the mills of orders sent in by the yards, but which by reason of inadequate, incomplete and inconsistent advices, district and general offices have had to hold, pending removal or irregularities by correspondence.

Generated on 2024-09-08 14:02 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

Trade Notes

C. E. Hague, formerly production engineer of the Mid-West Engine Company, Indianapolis, Ind., has been appointed sales manager of the American Steam Conveyor Corporation, Chicago, manufacturers of the American Steam Ash Conveyor and other ash handling equipment. Mr. Hague assumed his duties March 17.

Morse Chain Company, Ithaca, N. Y., announce that they are advised by P. A. Morse of the Morse Engineering Company their Western representatives, St. Louis, Mo., that the Kansas City offices have been removed from the old quarters in the R. A. Long Building, to more commodious rooms, Suite 211-212 Finance Building, where W. V. Warner, the office district manager will greet their friends.

C. R. Bulley has been appointed sales metallurgist to the Hess Steel Corporation in Baltimore. When the United States entered the war he was placed in charge of the design, building and operation of the heat-treating department of the Symington-Anderson Company, Ordnance, Rochester, manufacturers of 75 mm. field guns for the United States government. Prior to this he had several years experience in the metallurgical department of the Halcomb, Midvale and Carpenter Steel Companies.

The Epping-Carpenter Pump Company announces the appointment of F. S. Healey as manager of sales, in addition to his former office of chief engineer, vice F. F. Woods, who is now located in New York, as Eastern sales manager.

Albert A. Scheuch, of the sales department, has been appointed as assistant sales manager, and Paul D. Goodman, formerly of the McClary Jemison Machinery Company, of Birmingham, Ala., has been added to the sales personnel.

Willis B. Clemmitt has joined the engineering staff of the Powdered Coal Engineering & Equipment Co., of Chicago, in the capacity of advisory engineer. Mr. Clemmitt was formerly assistant superintendent of the open hearth department of the Central Iron & Steel Co., at Harrisburg, Pa.

George H. Ruppert who, before his entry into the chemical warfare branch of the service had charge of a sodium-ferro cyanide department of the Semet-Solvay Company, has accepted a position as advisory engineer with the Powdered Coal Engineering & Equipment Co., of Chicago.

Contract has just been awarded to the Treadwell Engineering Company, Easton, Pa., for a 34 inch two-high reversing blooming mill, roller tables, manipulator and shears, complete, by the Automobile Berliet, Usines Venissieux, Rhone, France.

At the organization meeting of directors of Air Reduction Company, Inc., New York, N. Y., held on February 19, 1919, the following officers were elected: A. S. Blagden, president; A. R. Ludlow, vice president; C. E. Adams, treasurer; M. W. Randall, secretary; C. L. Snow, assistant treasurer; C. C. Emerson, assistant secretary.

The stockholders of the A. Garrison Foundry Company of Pittsburgh, Pa., at the annual meeting held recently, elected directors as follows: John H. Ricketson, Jr., Oliver G. Ricketson, Jesse R. Williams, George W. Caulkett. The officers of the company are as follows: John H. Ricketson, Jr., president; Oliver G. Ricketson, vice president; Jesse R. Williams, general manager and treasurer; George W. Caulkett, secretary, assistant treasurer and assistant to the general manager.

The president, John H. Ricketson, Jr., has been serving as a captain with the Three Hundred and Fifteenth Infantry, American expeditionary forces, in France. The captain was badly incapacitated by shell shock during the battle of the Argonne Forest, but is now rapidly recovering. All of the officers are old employes of the company. The Messrs. Ricketson held the present positions during the late 90s. Mr. Williams comes from the accounting department, while Mr. Caulkett is transferred from the engineering and estimating department.

Freyn, Brassert & Co., engineers, Chicago, have been retained by the American Rolling Mills Company, blast furnace division, Columbus, O., as consulting engineers for improvements to be made at the company's two Columbus blast furnaces.

The Terry Steam Turbine Company makes the deferred announcement that since the death of Charles E. Hague in April, 1917, their interests in the Philadelphia district have been under the supervision of V. L. Sanderson, with headquarters at 605 Widener Building. They further announce that James H. Weir has recently become associated with them as assistant to Mr. Sanderson in that district.

The Electric Furnace Company, Alliance, O., is constructing for shipment to Mexico, complete Baily electric furnace equipment for melting brass. The furnaces are of the tilting type, and are rated at 105 kw electrical capacity, 1,500 pounds hearth capacity, and a melting rate of 600 pounds per hour. The equipment has been purchased by G. Amsinck & Co., New York, for exportation to Mexico.

The Hess Steel Corporation of Baltimore, Md., has established a branch office in the Kresge Building, Detroit, Mich. George B. Norcross, who is now representing the Hess Steel Corporation in that district will be in charge.

Trade Publications

The Westinghouse Electric & Manufacturing Co., of East Pittsburgh, Pa., has issued a complete catalog in which all of their electrical supplies are listed. In compiling the catalog every effort was exercised to make it of the greatest convenience to purchasers. The catalog is made up of 1,264 pages of description pertaining to the products of the company and a score of other pages contains a complete cross index, and index to style numbers, and a table of "Approximate Cost Multipliers," which enables one to figure the approximate cost of all supplies listed. Although the book is called a catalog, it contains a vast amount of information of a technical and engineering nature. Practical suggestions for the use of many kinds of apparatus for the transmission and utilization of electric power are given.

It is planned to issue this catalog annually. The publication of the catalog is quite noteworthy as it is the first book of such a nature published by an electrical concern having the wide diversity of products sold by the Westinghouse Company.

Powdered Coal—The Quigley Furnace Specialties Company, Inc., 25 Cortlandt street, New York, have recently issued Bulletin No. 11, describing the Quigley powdered fuel systems.

Circuit Breakers—The Automatic Circuit Breaker Company, Columbus, O., have issued Bulletin No. 301, describing their new types of breakers "ARL," "DRL" and "CRL."

Roller Bearings—The American Roller Bearing Company, Pittsburgh, Pa., have sent out Bulletin No. 1004, describing their Type "C" roller bearings.

The Pulverized Fuel Equipment Corporation has recently been organized for the purpose of taking over the business of the Locomotive Pulverized Fuel Company. The head offices are at 30 Church street, New York City.

Obituary

James M. Poyner, a prominent electrical engineer, for 10 years connected with the Baltimore office of the General Electric Company, died at the age of 37, of influenza, after an illness of 10 days, at Charleston, W. Va., on March 3, last.

Mr. Poyner was identified with many of Baltimore's new developments, being well known in engineering and business circles, and numbered among his friends some of Baltimore's most prominent business men. He was born in Alabama, where his parents, two brothers and three sisters, still reside. He was a graduate of Auburn College of Alabama; a member of the Engineering Club of Baltimore; the American Institute of Electrical Engineers, and the Maryland Country Club. Until he left the city, he resided at No. 3305 Alto avenue. He came to Baltimore from the Lynn works of the General Electric Company, and remained here until January 15, last, when he resigned to take up new work in Charleston, W. Va. The funeral and burial took place on March 5, in Raleigh N. C., where his widow, who was formerly Miss Mary Smedes, of that city, and three children, James M. Jr., George S. and Mary, will reside.

Generated on 2024-09-08 14:06 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF CHICAGO

The Blast Furnace and Steel Plant

Pittsburgh, April, 1919.

HH BUILDING PRODUCTS ROBERTSON CO BUILDING PRODUCTS

FORMERLY

ASBESTOS PROTECTED METAL CO

Through Longer Life Comes True Economy

Through the longer life of Robertson Asbestos Protected Metal comes true economy in Factory Buildings.

This *rust-proof*, *corrosion-proof* and *fire-resistant* Roofing and Siding will fully measure up to the requirements of railway construction. The illustration opposite tells the story of its metal protection.

Millions of square feet are now serving railway and industrial plants throughout the world.

Send for our latest bulletin and descriptive literature.

H. H. ROBERTSON COMPANY,
Formerly Protected Asbestos Metal Co.
First National Bank Bldg., Pittsburgh, U. S. A.

LONDON, ENGLAND: Dock House, Billiter Street.
For CANADA: Canadian Asbestos Co., Montreal.

Generated on 2024-09-08 14:05 GMT / https://hdl.handle.net/2027/chi.096839463
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

Digitized by Google

Original from UNIVERSITY OF CHICAGO